The other race was *Neotoma intermedia gilva.* The range ascribed by Goldman to this form in Baja California was on the desert slope from the International Boundary, southward along the Gulf slope to the vicinity of latitude 29°, thence "leap-frogging" westward to occupy the Viscaíno Desert region, including the Santa Clara Mountains bordering the Pacific Ocean.

Subsequently, these allocations were altered. Upon re-examination, specimens ascribed to *N. i. intermedia* along the mountainous-gulf area from latitude 28° south to La Paz, and those from the Sierra de La Victoria, were determined to belong to two different races and were named respectively *N. i. ravida* and *N. i. notia* by Nelson and Goldman (Proc. Biol. Soc. Washington, vol. 44, pp. 107-110, 1931).

Following the publication of these new races, Goldman, in the Journal of Mammalogy (*loc. cit.*), revised the *Neotoma lepida* group. In this account he revived Elliot's *Neotoma bella felipensis* (Publ. Field Columb. Mus. Zool. Ser., vol. 3, pp. 217-218, 1903), defining the "desert region, east of the San Pedro Mártir Mountains in northeastern Lower California" as its range. *Neotoma lepida gilva* was thus restricted, from its previously assigned gulf-desert strip of Baja California, to a small range near the International Boundary. No mention was made by Goldman, in this later revision, of the *Neotoma* occupying the Viscaíno Desert, nor were the ranges of either *intermedia* or *ravida* defined as covering that area.

In 1934, Orr named a race, *Neotoma lepida egressa* (Proc. Biol. Soc. Washington, vol. 47, pp. 109-112, 1934) from one mile east of El Rosario, Baja California, Mexico. This race was found to occupy the "coastal region of northwestern Lower California from latitude 31° N. south at least to El Rosario, latitude 30° 03′ N." In determining the characters of this race, Orr compared his specimens with specimens of *N. l. felipensis* from the opposite side of the peninsula and with those of *N. l. intermedia* from California to the northward. He found that the main characters of his newly defined race were most directly related to those of *N. l. intermedia.* This is also well demonstrated by specimens at the present writer's command.

No mention was made by Orr of his having seen or compared *egressa* with *ravida,* the nearest geographically named race to the southward at the date he made his study. There is a wide gap shown in a number of the characters of these two races, but of outstanding interest is the fact that both are dark colored. Specimens of *egressa* show a grizzled brown-gray cast or sheen in the pelage, while *ravida* lacks this tone and tends more towards black-gray. These differences are no doubt the result of environment, since *egressa* lives in a humid coastal region where, in places, heavy chaparral abounds, while *ravida* lives in volcanic, black lava country, where vegetation is usually sparse.

The race *N. l. molagrandis,* named herewith, has some characters that are intermediate between those of *egressa* and *ravida,* but the large molariform teeth and flaring zygomatic arches are trenchant, placing the relationship of *molagrandis* nearer that of the *intermedia-egressa,* rather than the *felipensis-ravida,* line. Geographically this would be expected. However, there is still much

to be learned about the *Neotoma* populations living in the region between the southern base of the Sierra San Pedro Mártir and the northern edge of the Viscaíno Desert.

Specimens examined.—Neotoma lepida intermedia. California, San Diego County: Murray Dam near La Mesa, 3; Mission Gorge, 3; Alvarado Canyon near La Mesa, 1; San Diego, 1; Bonita, 3; Witch Creek, 1; mouth of Tia Juana River, 1. Baja California, Mexico: Valle de Las Palmas (below Tijuana), 1; Valle de La Trinidad, 14; Summit San Matias Pass, 3.

Neotoma lepida egressa. Baja California, Mexico: San Quintín, 4; Aguaita, 1.

Neotoma lepida molagrandis. Baja California, Mexico: Punta Prieta, 2; Mesquital, 2; Santo Domingo Landing, 2 (type locality); Calmallí, 1; 12 mi. e. El Arco, Rancho Miraflores, 1; Santa Gertrudis Mission, 1; San Ignacio, 3 (not typical).

Neotoma lepida gilva. California, San Diego County: La Puerta Valley, 20. Baja California, Mexico: Gaskill's Tank, near Laguna Salada, 4.

Neotoma lepida felipensis. Baja California, Mexico: San Felipe, 10 (type locality).

Neotoma lepida ravida. Baja California, Mexico: south end Concepción Bay, 7; Comondú, 5 (type locality).

TRANSACTIONS

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THE GLOSSY SNAKE, ARIZONA, WITH DESCRIPTIONS OF NEW SUBSPECIES

BY

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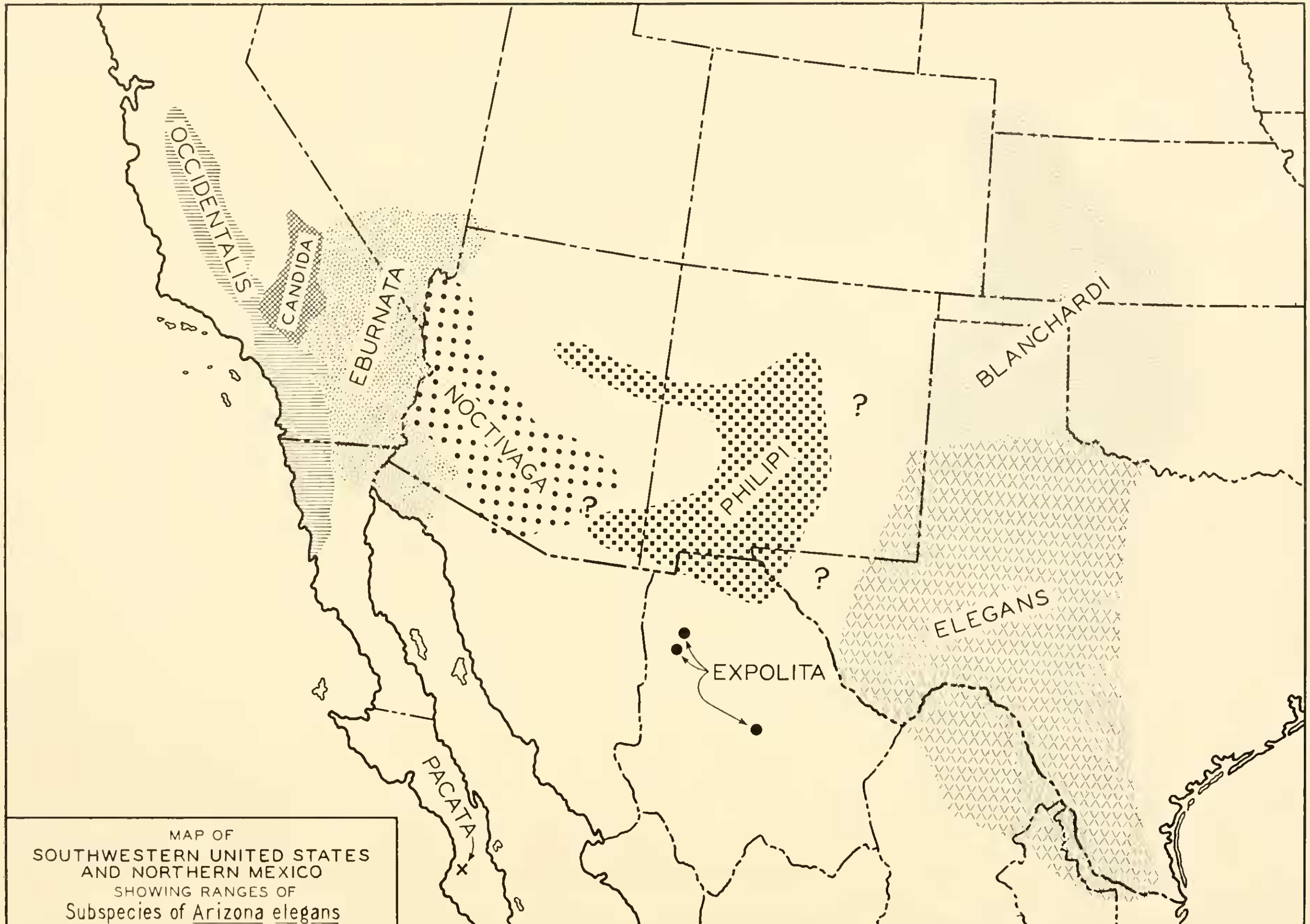

MAP OF
SOUTHWESTERN UNITED STATES
AND NORTHERN MEXICO
SHOWING RANGES OF
Subspecies of *Arizona elegans*

THE GLOSSY SNAKE, ARIZONA, WITH DESCRIPTIONS OF NEW SUBSPECIES

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INTRODUCTION

The glossy snakes, or, as they are sometimes less suitably called, the faded snakes, genus *Arizona,* comprise a monotypic genus inhabiting the southwestern United States and northern Mexico. Of late years new methods of collecting, particularly by driving on paved desert roads at night, have considerably increased the numbers of specimens in study collections, so that good series are now available from several localities, and territorial differences may be determined with a greater assurance of validity. This genus was once thought to be rare, but is now known to be among the commonest of snakes in some sections of the southwest, particularly in parts of the Mojave and Colorado deserts. In Texas the glossy snakes are diurnal or crepuscular; in the western deserts they are almost entirely nocturnal.

HISTORICAL SUMMARY

The genus *Arizona,* type species *elegans,* was set up by Kennicott in 1859, being differentiated from *Pituophis* by its paired prefrontal scales and smooth dorsals, whereas in *Pituophis* the prefrontals usually number 4, and the central dorsals are always keeled. Both *Arizona* and *Pituophis* are characterized by undivided anal plates and a relatively high number of scale rows.

In 1860 and 1861 Cope described two new subspecies, *Arizona jani* and *A. lineaticollis.* These have paired prefrontals but keeled dorsals, thus breaking down one of the differences first presumed to segregate *Arizona* from *Pituophis.* This confusion led Cope to assign *elegans* to the genus *Pituophis* in 1875 (or *Pityophis* as it was then called), and to *Rhinechis* (an Old-world genus) in 1886. This latter arrangement was continued by some authors until as late as 1907. Eventually (1894) *lineaticollis* and *jani* were properly assigned to *Pituophis* by Günther (*jani* as a synonym of *P. deppei*), and *Arizona* again became monotypic, although not so recognized by Günther, who continued *elegans* in *Pituophis.* However, *Arizona* had been revived for *elegans* by Bocourt in 1888 and has been recognized by most herpetologists since, although Boulenger (1894) placed both *Arizona* and *Pituophis* in the genus *Coluber,* a genus

notably composite as set up by him, but comprising primarily snakes which today would be referred to the genus *Elaphe*.

The genus *Rhinechis* is now usually considered a synonym of *Elaphe* by European herpetologists, *e.g.*, Mertens and Müller, 1928; but in any case *Arizona* differs from *Rhinechis* in having a slightly elliptical pupil (as pointed out by Van Denburgh, 1906, p. 66), in having an undivided anal plate, and single rather than paired apical scale pits. Thus present-day herpetologists are agreed on the recognition of *Arizona* as a monotypic genus.

Subsequent to the original description of *Arizona elegans*, only one additional subspecies has been recorded. In 1924 Blanchard (p. 1) described *Arizona elegans occidentalis*, type locality La Jolla, California, differentiating it from the eastern form, *A. e. elegans*, by its reduced scale rows, more numerous and narrower blotches, less prominent lateral spots, and shorter tail. He considered southeastern Arizona to be the area of intergradation between the two subspecies.

Although *Arizona* is now generically separated from *Pituophis*, it is recognized that the relationship is close. The hemipenial differences are slight (*cf. p. 355*). Walls (1934, p. 899), in his investigations of eye structure, found *Arizona* intermediate between such nocturnal snakes as *Phyllorhynchus* and *Hypsiglena*, and certain diurnal genera, particularly *Pituophis*. He states: "The diurnal genus *Pituophis* stands very close to *Arizona* and is probably the genus from which the latter was derived. *Arizona* can thus be thought of as a *Pituophis* which has become generically distinct partly as a result of changes accompanying its tendency toward nocturnality." It may be noted that *Arizona*, in scalation, most nearly resembles the least specialized (and probably most primitive) forms of *Pituophis*, *P. deppei* and *P. lineaticollis*, which are like *Arizona* in usually having only 2 prefrontals (instead of 4 as in most *Pituophis*), and in having 2 supralabials in contact with the eye.

With much new material available, it now becomes possible to describe several additional subspecies. Altogether I have had access to some 540 specimens, compared to the 33 available to Blanchard when his study was made.

Character Variation and Sexual Dimorphism

As is my usual practice in surveying a genus, I shall first investigate degrees of dispersion and sexual dimorphism in the largest territorially homogeneous series available to me. It has been my experience that coefficients of variation and sexual divergence tend to be rather constant for each character within a genus; hence if one is able to determine their values in one area, he will be better able to evaluate any differences found between subspecies, thus to some extent compensating for inadequate material. At the same time I shall discuss some of the character peculiarities of *Arizona*.

The two largest series at hand are from the Narrows–Dry Lake area of eastern San Diego County, and the Adelanto–Kramer area of western San Bernardino County, California. I have found it necessary not to include, as a part of the first-named series, a considerable number of specimens from be-

tween San Felipe Valley and the Narrows. for in this desert foothill region, separated by only a few miles from the desert beyond, some differences from the specimens of the desert flats to the eastward are already manifest.

On the characters having sufficient dispersion to be treated statistically, the data are as follows:

	Narrows–Dry Lake	*Adelanto–Kramer*
Number of specimens, males	25	40
females	16	13
Coefficients of variation, per cent		
Ventrals, males	1.41	1.24
females	1.50	1.40
Subcaudals, males	2.83	3.56
females	3.01	3.09
Body blotches	8.66	6.23
Tail spots	13.41	12.80
Coefficients of sexual divergence, per cent		
Ventrals	–3.98*	–4.99*
Subcaudals	9.62	9.38

We note here a considerable consistence in the coefficients of variation, and relatively narrow dispersions, particularly in ventrals and subcaudals. In *Arizona* the ventral dispersions are 1½ per cent or below; while the subcaudals run about 3½ per cent or below. In other genera the coefficients of variation in the ventrals generally average about 2 per cent, and in the subcaudals 5 to 6 per cent. With such local consistency, relatively small differences may warrant subspecific distinction. For example, homogeneous populations whose mean ventral counts are separated by 6 per cent (about 12 scutes in *Arizona*) would have about 2.3 per cent of specimens overlapping, while even differences of but 9 scutes would involve only 6.7 per cent of overlapping, if we assume normality of distribution (Klauber, 1941a, p. 5).

The sexual divergence in ventrals and subcaudals is somewhat less in *Arizona* than is general among colubrids†, and there is some overlapping between the sexes. As is usual, the females have more ventrals and fewer subcaudals than the males.

The variability in blotch counts, always higher than that of ventrals and subcaudals, is not greatly different from that found in other blotched snakes.

Some qualifications of the characters used in differentiation, as they are met in *Arizona*, are as follows:

There is more variation in scale rows than is evident in many genera. Variations of at least two rows are present in nearly every subspecies, and ranges of four rows are occasional. While most subspecies lean heavily toward one count (27, 29, or 31), some are fairly balanced between two. In such

* Minus signs indicate the females are higher than the males.

† For examples see Bull. San Diego Zool. Soc., no. 18, p. 14, 1943.

cases some sexual dimorphism is evident. For example, in 29 specimens from the vicinity of San Antonio, Texas, we have the following distribution:

	Scale Rows	
	29	*31*
Males	12	6
Females	3	8

There are 12 chances in 100 of such a disproportionate number of females with 31 rows having occurred fortuitously, if the scale rows were, in fact, not sexually dimorphic.

The scale-row criterion divides the subspecies of *Arizona elegans* into two groups: 1) *e. elegans* and *e. blanchardi* in the east, with 31 rows often present, although not necessarily in the majority, which may have 29; and 2) the other subspecies to the west and south in which 27 rows are always in the majority, although 29 rows may be present in up to 20 per cent or more of the population.

With respect to the ventral scutes, I have already mentioned the variability and sexual dimorphism in homogeneous samples. As is so often the case, this character is of the highest importance in *Arizona*, for considerable subspecific differences are found.

The subcaudals are less important—they seldom serve as useful key characters, since differences are less and overlaps greater. It is to be noted that comparatively few specimens have incomplete tails; also, it is less difficult to tell whether a tail is incomplete than in some genera—*Pituophis* and *Masticophis*, for example.

The supralabials do not constitute a useful character for they are too constant; there is no subspecies yet known in which 8 are not greatly in the majority. While there is more variability in the infralabials, it is more intra- than inter-subspecific. Furthermore, the count is often difficult to ascertain with accuracy, because of the overhang of the last supralabial. The serial number of the largest infralabial (counting back from the mental), which is easily ascertained with accuracy, may eventually prove of value in segregating some subspecies.

The loreals, postoculars, and temporals, although showing an occasional intrasubspecific variability, are too constant in number to be of importance in taxonomic work. On the other hand, in two areas there are trends, one quite strongly accentuated, toward the division of the normally single preocular.

The blotches, both in number and size, are found to be of importance in classification, for there are easily recognized territorial differences. It is true that observers may not always agree as to the number of dorsal body blotches in a specimen because of a lack of bilateral symmetry. Thus some blotches are diagonal; some are Y-shaped (paired on one side of the body and single on the other); while still others are confined to a single side of the middorsal line. Probably the best way to determine the number is to count each side separately and use the mean. The tail spots are still less accurately countable, for they are

often quite ill-defined, especially toward the tip. Frequently in some subspecies there is a middorsal light streak which splits these spots, and the last few may be represented only by irregular dark scale-edges.

Equally important with the number, are the relative sizes of the dorsal blotches and the interspaces which separate them. I have made it a practice to evaluate these at mid-body, selecting for study the most regular blotches to be found there. The transverse extent of a blotch is determined by counting the scale rows included, taking the dark edge of a blotch as the lateral limit. If this edge cuts across the middle of a scale, one half is counted on each side, thus resulting in an even total. The longitudinal extent of each blotch is measured in scales, end to end, and the interspaces are similarly determined. By averaging several blotches and interspaces, considerable accuracy can be achieved in these measurements. Using scales as units of measurement is preferable to attempting to gauge the relative extents of blotches and interspaces with the eye. These blotch dimensions are found, in a number of instances, to comprise quite adequate key characters wherewith to distinguish subspecies.

The lateral auxiliary series of blotches are somewhat less useful, although it is sometimes of interest to determine the lowest lateral rows darkened by the interblotch ground-color suffusions, and also the lowest marked by the brown spots which represent the remnants of obsolescent lateral blotches in the westerly subspecies.

I have discussed elsewhere* some of the difficulties involved in using tail-length proportionality in taxonomic work. In the genus *Arizona* the troublesome ontogenetic changes, although present, are of moderate extent. It is true that the juveniles have proportionately slightly shorter tails than adults (the opposite is the case in many genera) the difference being somewhat more pronounced in the females than the males. But as the differences are relatively small, and few juveniles are available in any of the series with which I have worked, I propose in these studies to use mean proportionalities, treating the sexes separately. Tail length proves to be of considerable importance in this genus; it rather sharply separates the forms of eastern Arizona and eastward, which are relatively long-tailed, from those found further west.

DESCRIPTION OF SUBSPECIES

I shall now proceed to the descriptions of the new subspecies, together with summaries of the old (*elegans* and *occidentalis*) as newly delimited. It has been the new material lately become available, rather than any new methods of approach, which has made these new segregations possible. The additional subspecies, far from complicating the picture, seem to me to lead to co-ordination and territorial consistency. Uncertainties and irregularities are manifest only where the material is still inadequate.

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* Bull. San Diego Zool. Soc., no. 18, pp. 5-60, 1943.

While intergrades are not yet at hand between all territorially contiguous pairs of subspecies, the relationships seem so close, and character overlaps are so evident, that I have considered all the available forms to be subspecies of *Arizona elegans*, thus continuing the monotypic status of the genus. As there are many areas in which *Arizona* should thrive from which specimens are not yet available, I should expect additional forms to come to light from time to time. There are many places where the most fruitful method of collecting (road cruising at night) cannot be practiced, and it may take years of collecting there to disclose the presence of so secretive and nocturnal a form as *Arizona*. I have in mind, especially, parts of north-central Mexico, central Baja California, and some of the islands off that peninsula.

I shall discuss the subspecies in territorial order, proceeding from east to west.

Genus *ARIZONA*

Arizona Kennicott in Baird: Reptiles of the Boundary, United States and Mexican Boundary Survey (Emory), vol. 2, p. 18, 1859. Type species *elegans*.

The body is moderately slender with the head slightly distinct. The tail is from 11 to 17 per cent of the length over-all. The tails of the males, in proportion to length over-all, average about 11 per cent longer than those of the females. The snout is rather sharp, with a sharply recurved rostral, and the underjaw deeply inset. The pupil of the eye in life is slightly elliptical, with the long axis vertical, although often round in preserved specimens. The head plates are normal. The nasal plates are usually separated below, but not above, the nostril. There is generally a single loreal, one preocular, and two postoculars; however, two preoculars are prevalent in some areas. Two supralabials touch the orbit. The temporals are commonly 2+3 or 2+4, but other combinations are not infrequent. The dorsal scales are smooth, in 25 to 31 rows at mid-body, and with faint single apical pits. The ventrals vary from 185 to 241; the anal plate is undivided; the subcaudals are in a double series numbering from 39 to 63. The ventral scutes have a sexual divergence of about 4 to 5 per cent in favor of the females, and the subcaudals 9 to 10 per cent in favor of the males.

The pattern comprises a series of bown blotches on a light-brown, buff, or cream, ground color. Smaller auxiliary blotches mark the sides. The ventrum is immaculate, although the lateral marks may touch the outer edges of the ventral scutes.

Arizona elegans elegans Kennicott

Texas Glossy Snake

Plate 7, fig. 1.

1859. *Arizona elegans* Kennicott in Baird: Reptiles of the Boundary, United States and Mexican Boundary Survey (Emory), vol. 2, p. 18. Type specimen USNM 1722; type locality Rio Grande (= Lower Rio Grande [River], Texas). Cotype USNM 4266; locality between

Arkansas and Cimarron (= between Arkansas and Cimarron rivers, Oklahoma). The cotype is now to be assigned to the new subspecies *blanchardi*.

1875. *Pityophis elegans* (part) Cope, Bull. U. S. Nat. Mus., no. 1, p. 39.

1883. *Pityophis catenifer* var. *deppei* (part) Garman, Mem. Mus. Comp, Zoöl., vol. 8, no. 3, p. 151.

1886. *Rhinechis elegans* (part) Cope, Proc. Amer. Philos. Soc., vol. 23, p. 284.

1894. *Coluber arizonae* (part) Boulenger, Cat. Snakes Brit. Mus., vol. 2, p. 66. (See remarks on this Boulenger name, under nomenclatorial and systematic problems.)

1894. *Pituophis elegans* (part) Günther, Biol. Cent.-Amer., Reptilia and Batrachia, p. 125.

1915. *Arizona elegans* (part) Strecker, Baylor Bull., vol. 18, no. 4, p. 34 (first mention of specimens from best differentiated area near San Antonio, Texas).

1924 *Arizona elegans elegans* (part) Blanchard, Occ. Papers Mus. Zoöl., Univ. Mich., no. 150, p. 3.

Diagnosis.—A subspecies characterized by 31 or 29 dorsal scale rows; and dark, well-defined blotches, longer than the interspaces. *Elegans* can be segregated from all subspecies except *blanchardi* by its having 31 or 29 scale rows, while the other subspecies usually have 27 rows, although they may occasionally have 29. However, those western subspecies which have the highest frequency of 29 rows (*occidentalis*, *eburnata*, and *noctivaga*), still average well below *elegans;* also, they have proportionately shorter tails and differ in various details of pattern. The subspecies most like *elegans* is *blanchardi*, which, however, has fewer ventrals and more body blotches, on the average, than *elegans*.

Nomenclatorial and Systematic Problems.—There is some uncertainty with regard to the exact locality of collection of the type specimen of *elegans*, USNM 1722. This is given as Rio Grande (Kennicott in Baird, 1859, p. 19) and later by Yarrow (1883, p. 108) as Lower Rio Grande. It was collected by A. Schott, and, as many of Schott's Texas specimens were collected at Eagle Pass, Maverick County, it may have come from that vicinity. The ventral count (male, 208), while low for *elegans* as found in southern Texas, cannot be considered sufficiently abnormal to prove that it came from some other point. The cotype, USNM 4266, from between the Arkansas and Cimarron rivers, while presumably from Oklahoma, may have come from Kansas or Colorado. In some ways this specimen would have constituted a more satisfactory type, since it may be more definitely allocated; but No. 1722 is the first named of the two, and besides was selected as the type by Blanchard, the first reviser. Also, it is the specimen shown in the original plate, the cotype being a female.

Boulenger (1894, p. 66) transferred the species *elegans* to the genus *Coluber*, and, as the name *elegans* was preoccupied in that genus, he assigned it the new specific name of *arizonae*. We now know that the transfer to *Coluber*

was incorrect, and in accordance with a decision of the International Commission on Zoological Nomenclature which is expected to be in print shortly, secondary homonyms so created are not to be regarded as permanent homonyms. Thus *elegans* remains valid; however, Boulenger did inadvertently describe the species *arizonae* which remains to be disposed of. He had two type specimens, one designated *a* from Duval County, Texas, the other, *b*, from Warners Ranch, San Diego County, California. Hence *arizonae* is a composite of two subspecies, *elegans* and *occidentalis*, and in order to avoid future confusion and the possible invalidating of Blanchard's *occidentalis*, I designate the British Museum specimen *a* from Duval County, Texas, as the lectotype of *arizonae* Boulenger, 1894, thus making it a synonym of *elegans* Kennicott, 1859.

Within the territory which Blanchard assigned to the subspecies *elegans*, there are available today fairly adequate series of specimens from western Kansas, Oklahoma, and the San Antonio section of Texas. If we compare the snakes of the most widely separated areas, western Kansas and San Antonio, we find a further segregation to be possible, the northern specimens being lower in ventrals and higher in blotch counts than the southern. There is, in fact, no overlap in ventrals when these limiting populations only are considered, the Oklahoma specimens being intermediate, as might be expected. To this extent the geographical picture is quite consistent, but there are complications. First, the type specimen of *elegans* is both uncertain as to locality and intermediate with respect to characters; second, inadequate material from the area lying south of the Texas Panhandle and west of San Antonio makes it difficult to allocate the specimens of this territory, for some of the few available are both confusing as to characters and from indefinite localities. There is an indication that specimens from the lower Rio Grande Valley average fewer ventral scutes than those from the vicinity of San Antonio or from the Chisos Mountains. After considering the factors involved, I have finally decided to assign to *elegans* the southern Texas specimens usually having high ventral counts and a low number of blotches, and to consider the northern form as the new subspecies. This makes the most consistent geographical arrangement. The northern form I shall describe as *blanchardi* after the late Dr. Frank N. Blanchard, the first reviser of this genus, who in 1936, learning I was considering the description of the Colorado Desert snakes as a new subspecies, generously suggested that I include in my study the eastern subspecies as well, although he had already begun gathering data on them. If, later, it be concluded that I have incorrectly assigned the type of *elegans*, then it is probable that the southern subspecies will take Boulenger's name *arizonae*. But it seems to me that geographical consistency is best served by the allocation I have made. Were it not that it seems best to begin these subspecies descriptions with the type subspecies, I should have preferred to start with the western subspecies, which, being represented by more adequate material and uncomplicated by an indefinite type specimen, present a more assured arrangement.

Material.—The discussion of *elegans* which follows is based upon 39 specimens from Texas, 29 males and 10 females. Only the Bexar–Atascosa–Comal counties area is adequately represented (by 30 specimens), the rest

being scattered about, including 4 from the trans-Pecos section. Much additional collecting will be necessary before the territorial trends in this subspecies can be fully determined. Two specimens from Coahuila are at hand, but they have not been included in the statistics which follow, since they are only tentatively assigned to this form. Necessarily the subspecific description which I present is strongly influenced by the predominance of material from the San Antonio area.

Description of Subspecies.—This is a snake of moderate colubrid proportions, neither heavy bodied nor attenuated. The head is only slightly distinct from the neck. Viewed from above, the head is wedge-shaped but with a rounded snout. From the side, the top of the head is slightly convex or flat; the jaw is deeply inset. The apex is moderately pointed; the forward part of the snout slants upward, so that the tip is toward the upper end of the rostral. The eyes are rather small and non-protuberant; the diameter is about equal to 60 per cent of the distance from the anterior edge of the orbit to the nostril. The pupil appears round in most preserved specimens but is slightly elliptical in life.

The longest specimen I have seen, a male from near Somerset, Atascosa County, Texas, measured 1386 mm. The smallest specimen measured 293 mm., and, having been collected on August 18, must have been but a few days old.* The tail proportion (ratio to length over-all) varies from 13.6 to 16.6 per cent in the males, and in the females from 13.5 to 14.8 per cent. The averages are respectively 14.9 and 14.2 per cent. It is believed that more extensive series would tend to raise the male figure; the sexual difference is usually a full per cent. The young specimens have proportionately shorter tails than the adults.

The hemipenis is single and widens outwardly. The inner half is almost covered with tiny points, although these are less evident on the side opposite the sulcus. At the middle of the shaft the organ widens rather suddenly and simultaneously the points increase in size. However, even the longest probably do not reach a millimeter in length and most are barely half that length, so they can hardly be referred to as spines. They are very densely set and are smallest in size along the sulcus.† At the outer end the points change to reticulated flounces, whose outer margins are edged with tiny points. At the outer end there is a truncated surface at an angle with the shaft; this contains an unreticulated groove, which is reached by the sulcus passing over the outermost part of the organ.

The body is covered with smooth scales, rather narrow and with slightly rounded ends. The lower lateral rows are increasingly enlarged. Single apical scale pits are faintly evident on some scales.

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* There is another specimen only 195 mm. in length but its condition is such I cannot be sure it is an *Arizona*. It has some scale peculiarities which distinguish it from all the others I have studied.

† The points in *elegans* are notably smaller and more plentiful than the spines in *eburnata* and *occidentalis*.

The scale rows at mid-body are usually 29 or 31, there being some sexual dimorphism so that the females more often have 31. One specimen from northern Texas has only 27 rows; it is possible that this may be a *philipi* intergrade. The ventrals in the males vary from 208 to 222, interquartile range 212.3 to 217.1, mean 214.71∓.72,* coefficient of variation 1.65 per cent; the over-all range in the females is from 220 to 232, interquartile range 223.1 to 227.1, mean 225.07∓.79, coefficient of variation 1.31 per cent. The anal is entire. The subcaudals, all divided, vary from 51 to 62 in the males, the interquartile range being 54.3 to 58.4, mean 56.36∓.62, coefficient of variation 5.47 per cent. In the females the over-all range is 49 to 53 (this range will no doubt be considerably enlarged when additional specimens shall have become available), interquartile range 50.7 to 52.5, mean 51.64∓.36, coefficient of variation 2.57 per cent. The coefficient of sexual divergence in the subcaudals is 8.7 per cent. The terminal scale is considerably elongated, with a lateral crease; it is seldom difficult to tell whether the tail is complete.

The head scales approach the colubrid normal in size and arrangement. The rostral is rather sharply curved, both over the top of the snout and below. It is wider than high. The upper point separates the internasals for about half their lengths; in addition it contacts the prenasals and the first supralabials. The internasals are longer than wide; they curve downward to a point in front of the prenasals. The prefrontals are wider than high and curve well down over the canthus rostralis to a level with the center of the orbit. The supraoculars are triangular in shape; they touch the prefrontals at a point and widen posteriorly, where they contact the parietals and upper postoculars. The frontal is widest anteriorly and terminates posteriorly at a point which does not deeply indent the suture between the parietals. The parietals are the largest of the head scales. They are moderately regular in shape, decreasing in size posteriorly. The dorsal scales which border them are somewhat enlarged, but are irregular. The prenasal is smaller than the postnasal; it is widest below, while the contrary is true of its fellow. The nostril is a slit at the upper end of the suture which divides them; it slants forward above. The suture is not complete above the nostril. The postnasal usually contacts the first and second supralabials. The loreal is twice as long as wide, and is highest forward, becoming pointed posteriorly where it abuts the preocular. The loreal contacts the second and third supralabials. Although divided loreals are occasional in the species, I have noted none in this subspecies. The preoculars are usually single, although paired in 2 counts out of 78. The preocular is somewhat wider above than below. The postoculars ordinarily number 2, and are subequal in size; there are 3 in one count out of 78. The temporals are usually 2+3 or 2+4, but vary from 1+2 to 3+5. Those in the first series are slim and elongated, and slant upward posteriorly. The supralabials are usually 8 but occasionally number 9 (10.5 per cent). The fourth and fifth contact the eye; the next to the last is always much the largest. The infralabials vary from 11 to 15, the distribution being 11(2),

* The minus-or-plus sign indicates that the following figure is the standard, rather than the probable, error of the mean.

12(10), 13(39), 14(22), and 15(1). The first pair meets on the median line. Usually the seventh is the largest of the series, although it may be the eighth if there are 14 or more in the series. The mental is small and triangular. The anterior genials are large and contact on the median line; the posterior are both slimmer and shorter, and, diverging posteriorly, are separated by from 2 to 4 rows of gulars.

Elegans is a brown snake with conspicuous dark-brown blotches down the back, and additional secondary blotches on the sides, which may or may not be obscured by a lateral suffusion of brown. It certainly cannot be called "faded."

The head is brown or red-brown above, and lighter-brown on the sides, shading into buff at the supralabials. There is a brown band, darker than the ground color, on the posterior edges of the prefrontals; also dark-brown spots on the supraoculars, frontal, and parietals, often concentrated along the sutures which separate these plates. There is a brown streak passing backward from the orbit to the angle of the mouth, and a vertical brown mark between the supralabials immediately below the eye; this tends to widen as the lip is approached. The lower jaw is usually immaculate, although the posterior infralabials are sometimes marked by a continuation of the postocular dark streak.

On the neck there is usually a pair of parallel dark marks separated by a light streak. These, the precursors of the dorsal series, may be joined together anteriorly, posteriorly, or both.

The dorsal blotches occupy considerably more longitudinal space than the interspaces which separate them. The body blotches vary in number from 42 to 56, interquartile range 46.6 to 51.7, mean 49.11∓.62, coefficient of variation 7.7 per cent. The tail spots have an over-all range of 13 to 24, interquartile range 16.0 to 19.9, mean 17.97∓.49, coefficient of variation 15.4 per cent. The body blotches at mid-body cover from 11 to 16 scale rows across the body, but in most specimens they span either 13 or 15 rows. The longitudinal extent of the blotches, again measured at mid-body, varies from 2 to 4 scales, end to end, but most specimens extend over 3 to 3½ scales. The interspaces are much narrower; most of them are but a single scale in length, but in a few specimens reach 1½ scales. The lateral brown suffusion is usually carried down to the third or fourth row above the ventrals. The lowest lateral spots of the auxiliary series extend considerably lower; in 70 per cent of the specimens they touch the outer edges of the ventrals, and in the others they reach the first row above.

The body blotches, although generally rectangular or elliptical, with the major axis transverse, are often quite irregular because the patterns of the two sides do not exactly match. This results in some diagonal blotches, and others which are restricted to one side, while still others are Y-shaped, being double on one side and single on the other.

In addition to the main dorsal blotches, there are, on each side, two or more alternating series of progressively smaller spots. The first of these series com-

prises subcircular spots, alternating with the dorsal series, and is rather regular; those below are elongated, irregular, and often indefinite.

The main dorsal blotches are dark-brown with darker-brown or black edges. There is often considerable red-brown in live specimens, but the red is lost in preservation.

Between blotches the ground color is cream or buff, but this is evident only on the 3 to 5 middorsal scale rows, for laterally the area between blotches is heavily suffused or punctated with brown. This darkening occurs particularly in scale centers; the scale edges are usually light, giving a net-work effect characteristic of *Arizona*. The lateral darkening tends to obscure the outer edges of the middorsal blotches and the lateral series as well; in some specimens the lateral suffusion is so dense as to blot out completely the side blotches. This side-darkening increases with age. Juveniles are usually quite clear between blotches.

A live specimen said to have been from New Braunfels, Texas, exhibited the following Ridgway (1912) colors: Ground color of the head, Wood Brown; lateral streaks on the head, Blackish Brown; centers of dorsal body blotches, Fuscous; edges of blotches, Black; middorsal interspaces, Mikado Brown centers, with Orange-Cinnamon edges; lateral blotches, Sepia to Black; centers of scales in lateral interspaces, Snuff Brown to Orange-Cinnamon; light edges of interspace scales, Pinkish Buff; ventrum Pale Olive-Buff.

Intrasubspecific Trends.—The ventral scutes reach a maximum in the San Antonio area, and the body blotches attain a minimum there, except for two Coahuila specimens, somewhat doubtfully allocated to this subspecies. Specimens from the Chisos Mountains are also high in ventrals, but those from the intervening territory are lower. I have discussed some of the questions brought up by individual specimens under "Nomenclatorial and Systematic Problems."

The two specimens from Coahuila are low in both ventrals and body blotches. One is a male with 205 ventrals and 55 subcaudals, the other a female with 211 ventrals and an incomplete tail. The labials and oculars do not differ from those of Texas *elegans*. The male has 40 body blotches and 14 tail spots, the female 43 blotches. The blotches are both wide and long, greatly exceeding the interspaces as in *elegans*. Both specimens have 31 scale rows, showing an affinity toward *elegans* and *blanchardi*, rather than *philipi* or any other subspecies farther west. Should further collecting in Coahuila continue to produce specimens as low in ventrals and body blotches as these, recognition of another subspecies may be justified.

Relationships with Other Subspecies.—*Elegans* intergrades with *blanchardi*, but the exact zone of intergradation cannot now be determined for lack of material. Tentatively I have presumed the line to be the Red River and the southern end of the Texas Panhandle. To the west there is little doubt that *elegans* intergrades with *philipi*, this being suggested by several specimens having indefinite localities but presumed to be from the trans-Pecos area of Texas. The critical area, with respect to this relationship, is Hudspeth and Culberson

counties, from which no specimens are at present available. A specimen (MZUM 81984) from Lubbock, Lubbock Co., Texas, having 27 scale rows and 208 ventrals (male), suggests that this part of Texas also may be an area of intergradation between *philipi* and *elegans*. The determination of the relationship of *elegans* with the specimens from Coahuila and, through them, with *expolita* must also await further collecting.

Life History Notes.—I have had no personal field experience with this subspecies. Such first-hand information as I am able to supply on *Arizona* will be found under the western subspecies, particularly *eburnata, candida,* and *occidentalis*. I am of the opinion that the several subspecies are much alike in habits, except that the eastern forms are less completely nocturnal.

Mr. Albert J. Kirn, of Somerset, Texas, has kindly supplied me with some interesting field notes on *elegans,* as found in that vicinity. He writes: "All of the specimens taken by me were found in the daytime; I do not recall seeing them at night. April 28, 1929, in the afternoon, I came upon an *Arizona* trying to swallow a mole (*Scalopus aquaticus texanus*) in a corn field. The snake had two coils around the body of the mole, and was doubled around the end of the mole so that the entire snake was only about 8 inches long. The snake had swallowed the head and one foot.

"At 6:30 a.m., September 5, 1932, I saw a small coral snake (*Micrurus fulvius tenere*) trying to swallow an *Arizona;* it had the head and a small part of the body swallowed. The coral snake measured 18⅞ in. and the *Arizona* 12⅞ in.

"My earliest record for 1944 was Feb. 23, that of 1945, March 4. When I come upon any of these snakes they usually contract themselves into short bends or kinks for the entire length of the body. One, for example had 11 kinks. I do not know if this is done for fright or if it is a method of defence; they never offer to strike. They do not coil, but remain in a traveling position. This is, of course, in the daytime.

"These snakes are frequently plowed up by farmers when breaking land. This would indicate that they do not go deep into the ground; probably they seek refuge in mole, kangaroo rat, or possibly pocket gopher holes.

"Most of the specimens I have secured are from 7½ miles southwest of Somerset. The country roundabout is sandy to very sandy. There are woods and cultivated fields. The woods, on more sandy land, are 'black jack' oak, mixed with hickory and live-oak. The topography is gently rolling; there is little rock except in gullies, and some sandstone outcrops. I think *Arizona* well-dispersed throughout this region, especially in the more sandy areas.

"One large female I collected, May 31, 1940, measured 42½ inches; it contained 12 eggs. Another laid 9 eggs."

Elegans, especially as found in the San Antonio area, is the largest and darkest of the subspecies. There is no doubt that it is more diurnal than the westerly subspecies.

This subspecies reaches an altitude of at least 3800 ft. in the Chisos Mountains.

Range.—Texas east of long. 98°, excluding the Panhandle and El Paso County; also, tentatively, northern Coahuila, Mexico.

Locality Records.—

TEXAS

BAYLOR COUNTY:
Seymour*
LUBBOCK COUNTY:
Lubbock†
HOWARD COUNTY:
10 mi. e. of Big Spring on US 80
REEVES COUNTY:
Pecos
BREWSTER COUNTY:
Between Marathon and Alpine
3 mi. w. of Government Spring (Chisos Mts., alt. 3800 ft.)
COMAL COUNTY:
New Braunfels
BEXAR COUNTY:
San Antonio (also 15 mi. s.)
Somerset
ATASCOSA COUNTY:
7 and 8 mi. s. of Somerset (Bexar County)
Benton
Poteet
10 mi. e. and 8 mi. ne. of Pleasanton
Lytle (also 4 and 7 mi. se.)
DUVAL COUNTY
KLEBERG COUNTY:
10 mi. sw. of Kingsville
BROOKS COUNTY:
11 mi. n. of Encino
HIDALGO COUNTY:
Edinburg
Also the following indefinite localities:
Lower Rio Grande (type locality)
Between Pecos River and Rio Grande

COAHUILA, MEXICO

Hacienda las Rusias (Ciudad Múzquiz)‡
Cuatro Ciénegas‡

Arizona elegans blanchardi subsp. nov.

KANSAS GLOSSY SNAKE

1859. *Arizona elegans* (part) Kennicott in Baird: Reptiles of the Boundary, United States and Mexican Boundary Survey (Emory), vol. 2, p. 18.

1875. *Pityophis elegans* (part) Cope, Bull. U. S. Nat. Mus., no. 1, p. 39.

1883. *Pityophis cantenifer* var. *deppei* (part) Garman, Mem. Mus. Comp. Zoöl., vol. 8, no. 3, p. 151.

1886. *Rhinechis elegans* (part) Cope, Proc. Amer. Philos. Soc., vol. 23, p. 284.

1894. *Pituophis elegans* (part) Günther, Biol. Cent.-Amer., Rept., p. 125.

1924. *Arizona elegans elegans* (part) Blanchard, Occ. Papers Mus. Zoöl., Univ. Mich., no. 150, p. 3

1929. *Arizona elegans elegans* Taylor, Univ. Kan. Sci. Bull., vol. 19, no. 5, p. 56 (first mention of specimens from Kansas, best differentiated locality).

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* Specimen no longer available, might be *blanchardi* or intergrade.

† May be *philipi* intergrade.

‡These are only tentatively assigned to the subspecies *elegans*.

Type.—No. 10393 in the collection of the Natural History Museum, Stanford University. Collected by J. W. Anderson, July 7, 1942, in Cheyenne County, Kansas, 13 miles southeast of Benkelman, Dundy County, Nebraska.

Diagnosis.—Blanchardi is a large-blotched, dark-colored, subspecies with 29 or 31 scale rows and a relatively long tail. While some western subspecies (*occidentalis*, *eburnata*, and *noctivaga*) occasionally have 29 scale rows, they have more blotches and shorter tails. *Blanchardi* has more ventrals than *philipi* or *expolita*. It is nearest to *elegans*, from which it differs in having, on the average, a lower number of ventrals and more blotches.

Description of the Type.—The type specimen is a young adult male; length over-all 752 mm.; tail length 119 mm.; tail proportion 15.8 per cent.

The head is convex on top; it is a little wider than the neck. The snout is pointed with the lower jaw inset. The pupil is nearly round. The distance from the anterior edge of the eye to the nostril is almost twice the eye diameter.

The scales of the head are normal. The rostral is hollowed below and is 20 per cent wider than high. It contacts the first supralabials, the anterior nasals, and the posterior point separates the internasals for more than half their lengths. The internasals are longer than wide and curve down to a point in front of the nasals. The prefrontals are quadrangular in shape, wider than long, with their post-lateral points curved well down over the canthus rostralis, to form a long contact with the loreal. The frontal is pentagonal, narrowing along the supraoculars and coming sharply to a point between the parietals. The supraoculars are very narrowly in contact with the prefrontals; they widen posteriorly. The parietals are large and contact more than half of the posterior edges of the upper postoculars. The postnasal is considerably larger than the anterior; the slit-like nostril is at the upper end of the diagonal separating suture, which is not complete above the orifice. Of the supralabials, the postnasal touches the first and second. There is a single loreal on either side, about twice as long as high and pointed posteriorly; it contacts the second and third supralabials. There is a single preocular on the right, and two, of which the lower is very small, on the left. The postoculars are 2–2 and are subequal. The temporals are 2+4, 2+3, the anterior being long and slender. The supralabials are 8–8; the fourth and fifth touch the eye and the seventh is much the largest. The mental is small and subtriangular. The infralabials are 13–14, the first on each side in contact with its fellow behind the mental, and the seventh on the right and eighth on the left much the largest. There are two pairs of genials, the anterior considerably the longer, and medianly in contact; the posterior are slightly divergent and are separated by two or three rows of gulars.

The dorsal scale rows are 29–31–19. The scales are smooth, rather narrow and with rounded ends. Single apical pits are faintly in evidence on some scales. The lower lateral rows are the widest. The ventral scales number 201; the anal plate is entire; there are 57 subcaudals, all divided.

The head is light-brown above and buff on the sides. There is a brown bar across the posterior edges of the prefrontals, and some dark-brown spots on the frontal, supralabials, and parietals. There is a wide, dark streak from each eye back to the angle of the jaw. There is a faint brown mark under each eye, otherwise the supralabials are unspotted. The lower surface of the head is immaculate buff. There is a pair of parallel dark blotches on the back of the head and beginning of the neck.

The dorsal body-pattern comprises a series of 58 rather irregular brown blotches, with dark-brown or black edges, on a buff background. The irregularity is due to the fact that the two sides do not match, so that some blotches are on one side only, while others are Y-shaped. The buff of the interspaces is evident only on the three middorsal scale rows, the others being heavily stippled with brown (except on their edges) whether within or between the main blotches. The effect is almost to obscure the lateral ends of the median blotches, and the lateral auxiliary blotches are quite submerged in the general brown color of the sides. At mid-body the blotches are about 2½ to 3 scales long (end to end), and 12 scale rows wide, across the back. The interspaces are about one scale long. The brown suffusion on the sides reaches the fourth lateral scale row above the ventrals. Some dark spots, the remains of the obsolescent auxiliary series, reach the ventrals themselves, which are otherwise immaculate cream-color. The tail spots are so obscured by the general brownish suffusion that they cannot be counted with accuracy. The unmarked dorsal interspaces form an almost continuous middorsal light line on the tail.

Summary of Paratypes.—Since, in the characters which distinguish *blanchardi* from *elegans*, the specimens from farthest north exhibit the greatest divergence, I have selected the type from northwestern Kansas and deem it desirable to summarize the northern specimens separately as paratypes, since the inclusion of those from New Mexico and Oklahoma (as is done in the complete subspecies description) to some extent compromises these differences. Thus I include as paratypes one specimen from Colorado, one from Nebraska, and 14 from Kansas.* The statistics on these (including the type) are as follows: There are 12 males and 5 females. The scale rows are 29(10), 30(2), or 31(5). The ventrals in the males vary from 197 to 206, mean 202.3; in the females from 207 to 213, mean 210.6. The subcaudals range from 55 to 63 (mean 57.3) in the males, and from 51 to 55 (mean 52.5) in the females. The supralabials are 8 in all cases, except for 7 on one side of one specimen. The infralabials are usually 13 (60 per cent) but vary from 11 to 14. The loreals are all single. There are two preoculars in 16 per cent of the counts, the others being single;

* LMK 35343 Schramm, Yuma Co., Colo.; WSC 41-197, 2 mi. se. of Stratton, Hitchcock Co., Neb.; and the following from Kansas: KU 2335 Ashland (Clark Co.); KU 3560 Little Salt Marsh (Stafford Co.); KU 3561-2 Elkhart (Morton Co.); KU 20097 near Syracuse (Hamilton Co.); KU 20785 4 mi. sw. of Duquoin (Harper Co.); KU 20784 1 mi. e. of Sharon (Barber Co.); KU 20793 Meade County State Park, KU 22206 6½ mi. sw. of Meade, AMNH 62848 12 mi. sw. of Meade (Meade Co.); USNM 89239 near Hutchinson, CHAS 12244 between Stafford and Sylvia (Reno Co.); and NHMSU 9912 and 9913 2 and 1 mi. se. of Dodge City (Ford Co.).

this is a higher percentage of paired preoculars than in any other subspecies except *candida*. There are two postoculars. The temporals are usually 2+3, but may be 2+2 or 2+4.

The body blotches vary from 51 to 66, mean 56.7, and the tail spots from 15 to 27, mean 21.5. The blotches at mid-body vary from 11 to 15, but are usually 12 or 13 scale rows in width across the body. The blotches are from 2 to 3 scales (end to end) in length; the interspaces are usually 1 or 1¼ scales in length, but may be as long as 1¾. Thus the blotches always exceed the interspaces in extent along the body. The brownish side-suffusion usually terminates on the first to third row above the ventrals, and the lowest auxiliary lateral blotches reach the ventrals or the first scale row above. In general these Kansas specimens are neither as dark, nor with as large or prominent blotches as are evident in *elegans* farther south.

The tail proportionality in these paratypes of *blanchardi* runs from 14.8 to 16.8 per cent in the males (mean 16.1), and 14.2 to 15.6 in the females (mean 14.9).

Material.—The description which follows is based on 15 specimens from Kansas, 1 each from Colorado and Nebraska, 2 from eastern New Mexico, and 17 from Oklahoma, total 36; of these 23 are males and 13 females.

Subspecies Description.—The scale rows are 29 to 31, about 58 per cent having the lower number. The ventrals vary from 197 to 215 in the males, the interquartile range being 201.4 to 207.9, the mean 204.63∓1.10, coefficient of variation 2.34 per cent. The females range from 207 to 222, interquartile range 211.2 to 217.9, mean 214.54∓1.38, coefficient of variation 2.32 per cent. The subcaudals, all divided, vary from 52 to 63 in the males, interquartile range 54.6 to 58.4, mean 56.53∓.68, coefficient of variation 4.97 per cent; and in the females the range over-all is 47 to 55, interquartile range 50.4 to 53.4, mean 51.90∓.72, coefficient of variation 4.4 per cent. The supralabials are rarely other than 8, there being one 7 and two 9's out of 66 counts. The distribution of the infralabials is 11(3), 12(13), 13(38), and 14(5). The loreals are nearly always undivided; only two out of 62 are split. The preoculars are single in 79 per cent; paired in the others. The postoculars nearly always number 2, although in two counts out of 70 there are 3. The temporals are usually 2+3 or 2+4, but vary from 2+2 to 2+6.

The body blotches vary in number from 47 to 66, interquartile range 53.0 to 60.1, mean 56.54∓.88, coefficient of variation 9.22 per cent. The tail spots range from 15 to 27, interquartile range 18.8 to 22.5, mean 20.65∓.56, coefficient of variation 13.03 per cent. The blotches cover from 11 to 15 scale rows, laterally; usually they are 12 or 13 rows wide. Longitudinally they extend from 1½ to 3¼ scales, end to end; most fall between 2 to 3 scales. The interspaces are shorter; while most of them occupy but a single scale, a few extend to as much as 1¾ scales. But the blotches are always of greater extent than the spaces between. The dark punctations on the sides extend down to the third to fifth lateral scale rows above the ventrals. The lateral secondary blotches

usually touch the ventrals, but in some specimens only extend to the first row above.

The longest specimen I have seen measured 1168 mm. This was a male; the longest female measured 1165 mm. These specimens were from Oklahoma; the Kansas specimens seem to be somewhat shorter. The shortest specimen measured 290 mm. The tail ratio (to length over-all) varies from 13.6 to 16.9 per cent (mean 15.7) in the males, and 13.8 to 15.6 (mean 14.7) in the females.

Intrasubspecific Trends.—In *blanchardi* the ventrals increase from the northwestern limit of the range, southward through Kansas to Oklahoma. The proportion of specimens having two preoculars is higher in Kansas than elsewhere.

The blotches decrease in number from Kansas southward, and the lateral spots reach lower scale rows in the northern part of the range.

Relationships with Other Subspecies.—*Blanchardi* intergrades with *elegans*, possibly along the line of the Red River and the southern end of the Texas Panhandle, but the zone cannot be located with assurance with the material presently available. Intergradation with *philipi* at the headwaters of the Canadian River in New Mexico is possible; *blanchardi* is found at least as far west as Clovis, Curry County (USNM 118532), and 21 miles southwest of Nara Visa, Quay County (CHAS 10126), New Mexico.

Life History Notes.—I have had no field experience with this subspecies.

Taylor (1929, p. 56) reports a specimen having been found crawling across the road in the daytime. But he believes the subspecies to be strictly nocturnal and its being abroad in the day very unusual. Two other specimens were collected at night.

Smith and Leonard (1934, p. 194) found two specimens in sand dunes in Oklahoma at 10 p.m. Burt and Hoyle (1934, p. 208) found one in sandy, sage-brush country, while another was in pasture land. The first was a female with 10 large eggs in the right oviduct and none in the left. Marr (1944, p. 485) found a specimen attempting to eat a trapped (dead) kangaroo rat (*Dipodomys ordii*).

This subspecies reaches an altitude of at least 3500 ft. in southwestern Nebraska and northeastern Colorado.

Range.—Northeastern Colorado, southwestern Nebraska, western Kansas, western Oklahoma, the Texas Panhandle, and northeastern New Mexico.

Locality Records.—

COLORADO

YUMA COUNTY:

Schramm

NEBRASKA

HITCHCOCK COUNTY:

2 mi. se. of Stratton

KANSAS

CHEYENNE COUNTY:
13 mi. sw. of Benkelman, Dundy County, Nebraska (type locality)
HAMILTON COUNTY:
Near Syracuse
STAFFORD COUNTY:
Little Salt Marsh
RENO COUNTY:
Hutchinson, between Stafford and Sylvia
5 mi. n. of Turon
FORD COUNTY:
1 and 2 mi. se. of Dodge City
MORTON COUNTY:
81 Ranch (near Elkhart)
MEADE COUNTY:
6½ and 12 mi. sw. of Meade
Meade County State Park
CLARK COUNTY:
Ashland
BARBER COUNTY:
1 mi. e. of Sharon
HARPER COUNTY:
4 mi. sw. of Duquoin

OKLAHOMA

BEAVER COUNTY:
2 mi. s. of Beaver
HARPER COUNTY:
2 mi. s. of Kansas line (s. of Englewood, Kansas)
WOODS COUNTY:
Alva
Waynoka
ALFALFA COUNTY:
3 mi. e. of Cherokee
DEWEY COUNTY:
½ mi. nw. of Taloga
BECKHAM COUNTY:
6 mi. e. of Erick
WASHITA COUNTY:
5 mi. ne. of Canute
CLEVELAND COUNTY:
Norman
GREER COUNTY
COMANCHE COUNTY
Also the following indefinite localities:
Neutral Strip
Between Arkansas and Cimarron rivers

NEW MEXICO

QUAY COUNTY:
21 mi. sw. of Nara Visa
CURRY COUNTY:
Clovis

Arizona elegans philipi subsp. nov.

PAINTED DESERT GLOSSY SNAKE

1896. *Arizona elegans* Cockerell, Amer. Nat., vol. 30, p. 326.

1900. *Rhinechis elegans* (part) Cope, Rept. U. S. Nat. Mus. for 1898, p. 862.

1924. *Arizona elegans occidentalis* (part) Blanchard, Occ. Papers Mus. Zoöl., Univ. Mich., no. 150, p. 1.

Type.—No. 34456 in the collection of LMK, collected 10 mi. east of Winslow, Navajo County, Arizona, by Charles E. Shaw and Carl Engler, July 29, 1941.

Diagnosis.—A subspecies characterized by a low number of ventral scutes and a relatively long tail. In the latter character it is like *elegans* and *blanchardi*, from which, however, it may readily be distinguished by its lower number of scale rows; *philipi*, like the other subspecies farther west, usually has 27 rows, while *elegans* and *blanchardi* have 29 or 31. From *noctivaga* and the other subspecies farther west, *philipi* may be distinguished by its longer tail; thus it is seen to be a transition form between the eastern and western subspecies—like the former in tail proportionality and the latter in scale rows. Only *expolita*,

a southern extension of *philipi*, occupies a similarly intermediate position, but *expolita* has fewer dorsal blotches than *philipi*.

Nomenclatorial and Systematic Problems.—Three paratypes of *philipi* are available from northeastern Arizona. One, LMK 20990, the first specimen to be collected in that area, is a juvenile taken by Philip M. Klauber (for whom I name the subspecies), August 20, 1933, at the crossing of Canyon Diablo with U. S. Highway 66 (= Two Guns), Coconino County, Arizona. It was this specimen whose peculiarities led to repeated trips to the Winslow area in search of further material, but without success until the Shaw-Engler expedition of 1941. The initial specimen was not selected as the type because it is a juvenile and, further, has some abnormal head scales not found in any other specimen. The two other paratypes are a topotype, LMK 34426, also taken by Shaw and Engler; and PFNM 123, collected one mile from Second Forest (alt. 5500 ft.), Petrified Forest National Monument, Apache County, Arizona, by L. F. Keller, October 5, 1943.

It was at first thought that this subspecies was restricted to this section of Arizona, the snakes of central New Mexico and the El Paso area being assigned to the southern Arizona subspecies, *noctivaga*. However, tail-length studies later showed the New Mexico–El Paso snakes to belong with *philipi*, rather than *noctivaga*. But I have seen fit to leave the selection of the type unchanged, for the snakes of the Painted Desert area are the lowest in ventral scale counts and are most differentiated from *noctivaga* in some other characters. Later, if additional material should justify a further division of *philipi*, a new name may be assigned to the southern race.

Description of the Type.—The type specimen is an adolescent male; length over-all 565 mm.; tail length 94 mm.; tail proportion 16.6 per cent. The measurements were made before shrinkage in preservative.

The head is flat-topped and rather narrow, so that it is only slightly distinct from the neck. The snout is pointed and somewhat uptilted. The pupil is almost round.

The scales of the head are normal. The rostral is wider than high; it is sharply recurved with the posterior point inserted between the internasals for about half their lengths. The internasals are longer than wide and have sharp points between the rostral and prenasals. The prefrontals are quadrangular in shape, wider than long, and with their postlateral points curved down over the canthus rostralis. The frontal is hexagonal, narrowing considerably along the supraoculars and then terminating in a sharp point between the parietals. The supraoculars touch the prefrontals at a point; they widen somewhat posteriorly. The parietals contact nearly the entire posterior edges of the upper postoculars. Posteriorly they are edged by normal dorsal scales. There is a suture below the nostril, not above; the postnasals are the larger of the pair. Of the supralabials, the postnasal touches the first and second, the latter only at a point. There is a loreal on either side about twice as long as high, touching the second and third supralabials. Posteriorly it is curved and indents the preocular. On the left side there is an extra scale

below the loreal which has been cut from a corner of the third supralabial. There is one preocular and two subequal postoculars. The temporals are 1+3, 1+3. The supralabials are 8–7, the fourth and fifth touching the eye, and the seventh largest. This refers to the right side only; the left is peculiar because of an incomplete suture between what should be the third and fourth supraoculars. The mental is small and triangular. The infralabials are 13–13, the first on each side being in contact behind the mental; the seventh is much the largest. There are two pairs of genials; the anterior pair are medianly in contact. They are longer than the posterior, which are divergent and separated by several gulars.

The dorsal scale rows are 25–27–19. The scales are smooth, rather narrow and with rounded ends. They are somewhat enlarged laterally. Single apical scale pits are faintly evident. The ventral scales number 185; the anal plate is entire; there are 51 subcaudals, all divided.

The head is light-brown above with dark-brown spots on the frontal and parietals. The sides of the head are lighter, particularly the supralabials; there is an indefinite dark streak from the eyes back toward the commissure. The lower surface of the head is cream-color, unmarked.

The body pattern comprises a series of brown blotches on a buff background. There are 57 blotches on the body, and 17 on the tail. The blotches are wider across the body than their longitudinal extent; at mid-body they are about 2 scales long (end to end), and 12 scale rows wide. The interspaces measure about 1½ scales (end to end). The blotches are dark-edged, some bordering scales being tipped with black. The interspaces show the buff ground color only on the three middorsal rows; laterally there is much spotting with brown, so as almost to obliterate the outer edges of the main blotch series. The three lowest lateral rows are cream-color, irregularly spotted with dark-brown or black at scale edges. A few spots even touch the edges of the ventrals, which otherwise are cream-color. The scales of the maculate lateral rows are usually lightest on the edges.

Summary of Paratypes.—As there is some intrasubspecific variation in the subspecies *philipi*, which might eventually lead to a further subdivision, I shall summarize separately, as paratypes, the three other available specimens from the Painted Desert area of Arizona, before discussing the subspecies in its entirety.

The paratypes agree in all essentials with the type, except that the specimen from Two Guns has some aberrant scales on the head.

The topotype is a young male measuring 405 mm. over-all, with a tail length of 68 mm. (preserved measurements). The scale rows are 25–25–17. The ventrals are 185; the anal entire; the subcaudals number 53, all divided. The head scales are normal. The supralabials number 8–8, infralabials 13–12, loreals 1–1, preoculars 1–1, postoculars 2–2, temporals 2+4, 2+2. There are 56 body blotches and 20 spots on the tail. The blotches are but little lighter middorsally than laterally; they are edged with black. The blotches are 12 scale rows in width and are about 2 scales long (end to end) middorsally; the inter-

spaces are 1½. A postocular dark-brown dash is evident on the side of the head. The first two paired spots on the neck are relatively short.

The Canyon Diablo specimen is a juvenile female, evidently hatched but a short time before collection. It measures 249 mm. over-all, with a 35 mm. tail. The markings are clear and bright, with brown blotches on a light-gray background. The scale rows are 27–27–19. The ventrals number 195; the anal is entire; there are 47 subcaudals. The head scales are anomalous in two particulars, the presence of extra loreals and suboculars. This was one of the reasons why so much effort was made to secure additional specimens from the vicinity, for it was hoped that the subspecies would be distinctive in head scales, which, however, proved not to be the case. The particular anomalies are: A small extra scale above the loreal on the right, and one below on the left; on both sides the fourth supralabial is divided transversely, and above this suture the scale is divided vertically, so that there are two suboculars on either side. There are 7–7 supralabials, and 12–12 infralabials. There is one preocular on each side and two postoculars. The temporals are 1+3, 2+3. There are 62 dorsal blotches on the body and 17 on the tail. The blotches are clear and evenly outlined. They average a little over 2 scales long, end to end, with interspaces of one scale. The brown postocular streak is clear and even.

The third paratype, PFNM 123, the only specimen from Apache County, is a female 615 mm. over-all, with a tail length of 89 mm., tail ratio 14.5 per cent. It has 197 ventral scutes and 46 subcaudals. The supralabials are 8–8, infralabials 12–13, loreals 1–1, preoculars 1–1, postoculars 2–2, and temporals 2+3, 2+3. The body blotches number 63; the tail spots are too indefinite to be counted with accuracy. The blotches are 12 scale rows wide and 1¾ scales (end to end) long; the interspaces occupy 1¼ scales. This specimen is considerably darker laterally than the type or other paratypes, the brownish suffusion being so dark and extensive as virtually to obliterate the lateral secondary blotches, particularly toward the tail.

Material.—The subspecific description which follows is based on the four specimens from northern Arizona already discussed, together with the following from other areas assigned to the same subspecies: Santa Fe County 2, Bernallilo County 5, Lincoln County 1, Sierra County 1, Grant County 1, Hidalgo County 1, Luna County 1, Doña Ana County 3, total New Mexico 15; El Paso County, Texas, 9; Cochise County, Arizona 2; northeastern Chihuahua 1; grand total 31. There are 14 males and 17 females.

Description of Subspecies.—This is a snake of medium colubrid proportions, neither slim nor stout. The head is slightly distinct from the neck. Viewed from above the snout is rounded. From the side, the top of the head is slightly convex or flat; the jaw is deeply inset. The apex is moderately pointed; it seems somewhat blunter than in the desert subspecies farther west. The forward part of the snout slants upward, so that the tip is at the upper end of the rostral. The eyes are somewhat protuberant; the diameter of the orbit is equal to about three-fourths of the distance from the anterior edge of

the orbit to the nostril. The pupil appears round in most preserved specimens but is slightly elliptical in life.

The longest specimen available, a female from El Paso, Texas, measured 903 mm., the smallest specimen 249 mm. The tail proportion (ratio to length over-all) varies from 15.2 to 16.9 per cent in the males, and from 13.8 to 15.9 per cent in the females. The averages are respectively 16.1 and 14.8 per cent.

The dorsal scales are smooth, rather narrow and with rounded ends. The lower lateral rows are slightly enlarged. Single apical scale pits are faintly evident on a few scales.

The scale rows at mid-body normally number 27, but 2 specimens out of 31 have 29, and one has 25. The ventrals in the males vary from 185 to 203, the interquartile range is 188.6 to 196.5, the mean 192.57 ∓ 1.58, and the coefficient of variation 3.06 per cent. The over-all range in the females is from 193 to 211, the interquartile range 199.2 to 207.2, mean 203.18 ∓ 1.44, and the coefficient of variation 2.92 per cent. The anal is entire. The subcaudals, all divided, vary from 51 to 57 in the males, the interquartile range being 52.2 to 54.3, the mean $53.21 \mp .42$, and the coefficient of variation 2.96 per cent. In the females the over-all range is 45 to 51, the interquartile range 46.7 to 49.0, the mean $47.88 \mp .41$, and the coefficient of variation 3.53 per cent. The coefficient of sexual divergence in the subcaudals is 10.5 per cent. The terminal scale is conical, with a longitudinal crease.

The head scales are normal in size and arrangement. The rostral is rather sharply curved, both over the top of the snout and below. It is wider than high. The upper point separates the internasals for about half their lengths; it also contacts the prenasals and the first supralabials. The internasals are longer than wide, curving downward to a point in front of the prenasals. The prefrontals are wider than high and curve well down over the canthus rostralis to a level with the center of the orbit. The supraoculars are narrower anteriorly where they touch the prefrontals; posteriorly they contact the parietals and upper postoculars. The frontal is widest anteriorly and terminates posteriorly at a point between the parietals. The parietals are the largest of the head scales. The dorsal scales which border them are somewhat enlarged and irregular. The prenasal is considerably smaller than the postnasal. The nostril is at the upper end of the suture which divides the nasals; it slants upward anteriorly. The suture is incomplete above the nostril. The postnasal usually contacts the first and second supralabials. The loreal is twice as long as wide, and is highest forward, becoming pointed posteriorly where it indents the preocular. The loreal borders the second and third supralabials. One specimen out of 30 has divided loreals. The preoculars are usually single, although paired in 2 counts out of 60; they are somewhat wider above than below. The postoculars number 2 in all specimens; they are subequal in size. The temporals are usually 2+3 or 2+4, but vary from 1+2 to 2+6 or 3+5. Those in the first series are attenuated, and slant upward posteriorly. The supralabials are usually 8, but may number 7 (7 per cent) or 9 (8 per cent). The fourth and fifth contact the eye; the next to the last is always much the

largest. The infralabials vary from 11 to 14, the distribution being 11(1), 12(14), 13(34), 14(5). The first pair meet on the median line. Usually the seventh is the largest of the series, although sometimes it is the sixth. The mental is small and triangular, with a sharp posterior point. The anterior genials are large and contact on the median line; the posterior are thinner and shorter; they diverge posteriorly and are separated by 2 to 4 rows of gulars.

Philipi is a light-brown snake with conspicuous dark-brown blotches down the back, and smaller secondary blotches along the sides, which may or may not be obscured by a lateral suffusion of brown. The blotches are distinctly more evenly-edged than is the case in *noctivaga* and the other subspecies farther west.

The head is light-brown above, and buff on the sides, being lightest on the supralabials. In some specimens there is a faint brown band, darker than the ground color, on the posterior edges of the prefrontals; in others, particularly adults, this has been lost. There are dark-brown spots on the supraoculars, frontal, and, especially, the parietals. These spots are present in greater number than in the westerly subspecies. There is a brown streak from the eye to the commissure. The lower jaw is immaculate.

On the neck there is usually a pair of parallel dark marks separated by a light streak; these are the first of the dorsal series.

The dorsal blotches occupy considerably more longitudinal space than the interspaces which separate them. The body blotches vary in number from 52 to 72, interquartile range 58.6 to 65.4, mean 62.00∓.88, coefficient of variation 8.1 per cent. The tail spots have an over-all range of 15 to 23, an interquartile range of 17.7 to 20.8, mean 19.25∓.47, coefficient of variation 12.0 per cent. The body blotches at mid-body usually cover 11 or 12 scale rows across the body, but a few span 13 or 15 rows. The longitudinal extent of the blotches, again measured at mid-body, varies from 1½ to 2½ scales, end to end, but most specimens measure 2 scales. The interspaces are narrower; most of them are but a single scale in length, but in a few specimens reach 1¼ or 1½ scales. The lateral brown suffusion is usually carried down to the third or fourth row above the ventrals. The lowest lateral spots of the auxiliary series extend considerably lower; in more than half of the specimens they touch the outer edges of the ventrals, and in most of the others they reach the first row above.

The body blotches, although generally rectangular or elliptical, with the major axis transverse, are sometimes irregular because the patterns of the two sides do not exactly match. This results in a few diagonal blotches, and others which are restricted to one side, while still others are Y-shaped, that is, double on one side and single on the other.

In addition to the main dorsal blotches, there are, on each side, about four alternating series of progressively smaller spots. The first of these series comprises subcircular spots, alternating with the dorsal series, and is fairly regular; those below are irregular, and often indefinite.

The main dorsal blotches are brown, with darker-brown or black edges. Between blotches the ground color is buff, this being evident middorsally and on

the lowest lateral rows. The ventrum is immaculate. But dorso-laterally the area between blotches is suffused or punctated with brown. In some specimens the lateral darkening tends to obscure the outer edges of the middorsal blotches and the lateral series as well; in a few the lateral suffusion is so dense as to blot out the side blotches completely. This side-darkening increases with age; juveniles are usually quite clear between blotches.

Intrasubspecific Trends.—Since *philipi* occupies areas of considerable ecologic diversity, it exhibits, as might be expected, some definite character variations.

The scale rows are slightly higher in the El Paso area, where specimens with 29 rows are not uncommon. The ventrals are at a minimum in the Winslow area, showing an increase eastward toward Albuquerque and thence south to El Paso. The subcaudals and labials have a similar trend.

The blotches also increase in number from Winslow to El Paso. The lateral blotches reach lower scale rows in northwestern New Mexico specimens than in the snakes of the El Paso area.

Relationships with Other Subspecies.—The possibility of the intergradation of *philipi* with *elegans* and *blanchardi* has already been discussed under those subspecies. All of these forms belong to the long-tailed group. *Philipi* differs from *elegans*, first of all, in scale rows; the fact that the snakes of the El Paso section occasionally have 29 rows suggests that the connection is probably in trans-Pecos Texas.

There is no doubt that *philipi* intergrades with *expolita*, since they differ only in the number of body blotches, and there is no ecological barrier between them. But the actual relationship can only be determined when more material becomes available, particularly between the most southerly *philipi* (MVZ 24388, 1 mi e. of Samalayuca, Chihuahua), and the most northerly *expolita* (USNM 46374 from Casas Grandes, Chihuahua). These two localities are about 115 miles apart. The same lack of material from critical points prevents a determination of the relationship of *philipi* with *noctivaga*. One belongs to the long-tailed, the other to the short-tailed group. If serious consideration be given to the separation of *Arizona elegans* into two species, it is probable that the division should be made between these two, representing the westerly representative of the long-tailed group, and the easterly of the short-tailed forms. Yet intergradation is by no means impossible; it may involve the snakes between the Tombstone and Tucson areas, or those between Canyon Diablo and Congress Junction, by way of Oak Creek and Sedona. *Arizona* has been collected at Oak Creek; unfortunately the specimens are not now available so that I do not know which subspecies occurs there, or whether they show any intermediacy between *philipi* and *noctivaga*. The gap in characters over either route is by no means insurmountable, although the specimens from nearest to the gaps do not exhibit pronounced intergradative tendencies.

Life History Notes.—This subspecies is presumed to be quite nocturnal, particularly during its season of greatest activity. Shaw and Engler collected the

type specimen at 11:10 p.m., temperature 72° F. Two specimens were collected near El Paso in the late evening.

This subspecies reaches an altitude of at least 5500 ft. It is found in semi-desert areas with sparse vegetation, such as those near Winslow and El Paso, but in other sections inhabits ground with a heavy brush cover.

Range.—The Painted Desert, or Little Colorado River area of northeastern Arizona; central New Mexico, from Santa Fe, south and southwest, to the Mexican Boundary; extreme southeastern Arizona (Cochise County); El Paso County, Texas; and extreme northern Chihuahua.

Locality Records.—

ARIZONA

COCONINO COUNTY:
Canyon Diablo at US 66 (= Two Guns)
Oak Creek Canyon (22 mi. s. of Flagstaff)*
NAVAJO COUNTY:
10 mi. e. of Winslow (type locality)
Shongopovi†
APACHE COUNTY:
1 mi. from Second Forest (Petrified Forest National Monument) (alt. 5500 ft.)
COCHISE COUNTY:
25 mi. s. of Cochise (on US 666)
Near Bowie

NEW MEXICO

SANTA FE COUNTY:
Arroyo Hondo (8 mi. sw. of Santa Fe)
BERNALLILO COUNTY:
Albuquerque (also 11 mi. n.)
Isleta Indian Reservation (ponds on east side of Rio Grande)
3 mi. w. of Rio Grande (near Albuquerque)
LINCOLN COUNTY:
Capitan Mountains‡
SIERRA COUNTY:
Las Palomas
GRANT COUNTY:
26 mi. e. of Lordsburg (Hidalgo County)
HIDALGO COUNTY:
Lordsburg
LUNA COUNTY:
29 mi. se. of Silver City
DONA ANA COUNTY:
Acacia
Las Cruces
Mesilla Valley

TEXAS

EL PASO COUNTY:
El Paso (also 2 mi. e. and 2 mi. ne.)
Sand Hills ne. of El Paso
Near Tornillo

CHIHUAHUA, MEXICO

1 mi. e. of Samalayuca

Arizona elegans expolita subsp. nov.

CHIHUAHUA GLOSSY SNAKE

1886. *Rhinechis elegans* (part) Cope, Proc. Amer. Philos. Soc., vol. 23, p. 284.
1888. *Arizona elegans* (part) Bocourt, Miss. Sci. Mex., Rept., p. 676.
1894. *Pituophis elegans* (part) Günther, Biol. Cent.-Amer, Rept., p.125.

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* Specimen no longer available, subspecies doubtful.
† Reported by Bogert, 1933, p. 219—probably this subspecies.
‡ Location somewhat uncertain.

1894. *Coluber arizonae* (part) Boulenger, Cat. Snakes Brit. Mus., vol. 2, p. 66.
1924. *Arizona elegans occidentalis* (part) Blanchard, Occ. Papers Mus. Zoöl., Univ. Mich., no. 150, p. 1.

Type.—No. 46374 in the collection of the U. S. National Museum. Collected May 27, 1899, by E. W. Nelson and E. A. Goldman at Casas Grandes, Chihuahua, Mexico.

Diagnosis.—A subspecies characterized by a low number of ventrals and body blotches. It has fewer body blotches than any other subspecies except *elegans* and *pacata*. From the former it may be distinguished by its fewer scale rows (27 instead of 29 or 31 as in *elegans*) and fewer ventrals. From *pacata* it may be segregated by its proportionately longer tail. While the numbers of specimens of each subspecies are too few to set limits, it is believed that *expolita* is one of the longest tailed of the subspecies, while *pacata* will prove to be one of the shortest. Although *expolita* resembles *philipi* in having a low number of ventrals, it has fewer blotches than *philipi*.

Description of the Type.—The type specimen is a young male; length over-all 510 mm.; tail length 78 mm.; tail proportion 15.3 per cent.

The head is slightly convex on top; it is little wider than the neck. The snout is pointed and recurved below; the lower jaw is inset. The pupil is nearly round.

The scales of the head are normal. The rostral is hollowed below and is wider than high. It contacts the first supralabials, the anterior nasals, and the posterior point separates the internasals for slightly more than half their lengths. The internasals are longer than wide and curve down to points in front of the nasals. The prefrontals are quadrangular in shape, with their post-lateral points curved well down over the canthus rostralis. The frontal is pentagonal, narrowing along the supraoculars and then more sharply between the parietals. The supraoculars are narrowly in contact with the prefrontals; they widen posteriorly. The parietals are large and touch half of the posterior edges of the upper postoculars. The postnasal is considerably larger than the anterior; the nostril is at the upper end of the separating suture, which is not evident above the orifice. Of the supralabials, the postnasal touches the first and second. There is a single loreal on either side about twice as long as high, touching the second and third supralabials. There is one preocular on each side, somewhat wider above than below. The postoculars are 2–2 and are subequal. The temporals are 2+3, 2+4. The supralabials are 8–8, the fourth and fifth touching the eye, and the seventh much the largest. The mental is small and subtriangular. The infralabials are 12–12, the first in contact behind the mental, and the sixth much the largest. There are two pairs of genials, the anterior considerably the longest, and medianly in contact; the posterior are slightly divergent and are separated by two or three rows of gulars.

The dorsal scale rows are 27–27–17. The scales are smooth, rather narrow and with rounded ends. The middorsal and lateral rows are the widest. The

ventral scales number 195; the anal plate is entire; the subcaudals are 49, all divided.

The head is buff above and lighter on the sides. There is a brown bar across the posterior edges of the prefrontals, and some brown mottling on the frontal and parietals. There is a wide, dark streak from each eye back to the angle of the jaw. The lower surface of the head is immaculate white.

The dorsal body pattern comprises a series of 45 rather irregular brown blotches, with dark-brown edges, on a buff background. The irregularity is due to the fact that the two sides do not match, so that the blotches are sometimes diagonal and others Y-shaped. At mid-body the blotches are about 3 scales long (end to end), and 13 scale rows wide, transversely. The interspaces are about one scale long. The ground color is most evident on the three middorsal scale rows, for laterally the scales between blotches are somewhat suffused with brown. In addition to the main blotches there is an auxiliary series of dark-edged brown spots on each side; these generally alternate with the main series. Below the auxiliary series, many scales are irregularly streaked with brown, although the lowest lateral rows are not suffused with brown. A few of the brown spots are present on the outer edges of the ventrals, the ventrum being otherwise white. On the neck there is a pair of dark blotches separated by a narrow, middorsal light streak. About 9 scales behind the parietals, these two blotches join to form the first of the dorsal series. There are 16 spots on the tail.

Summary of Paratypes.—Two paratypes of this subspecies are available: USNM 14298 from Chihuahua* and AMNH 4344 from San Diego, Chihuahua. They agree in all essential particulars with the type, showing the same differences from the nearest relative, *philipi*.

The Chihuahua (City) specimen is a young male 572 mm. over-all with a tail length of 94 mm., ratio 16.4 per cent. The scale rows are 25–27–19, ventrals 194, anal entire, subcaudals 53, supralabials 8, infralabials 12 on the left, indeterminate on the right, loreals and preoculars single, postoculars two, temporals 2+3. The body blotches number 50 and the tail spots 20. The blotches cover about 13 scale rows laterally, and 3 scales end to end longitudinally. The interspaces average 1¼ scales. The side suffusion reaches the third lateral above the ventrals, while the lowest lateral spots touch the edges of the ventrals.

The San Diego (Chihuahua) specimen is an adult female 785 mm. long, with a 98 mm. tail, ratio 12.5 per cent. The scale rows are 29–27–20, ventrals 207, anal entire, subcaudals 39, supralabials 9–8, infralabials 12–13, loreals 2–2 (there is a vertical suture in each), preoculars 1–1, postoculars 2–2, temporals 2+3, 2+4. The body blotches number 50 and the tail spots 12. The blotches at mid-body cover 12 scale rows transversely, and 3 scales end to end longitudinally. The interspaces measure 1¼ scales. The side suffusion reaches the

* Although catalogued from Chihuahua, it is known that Wilkinson, the collector, worked in the vicinity of the City of Chihuahua, and Cope, who first reported on the specimen, considered that it came from the city or nearby (Cope, 1886, p. 282).

fourth lateral row above the ventrals, while the lowest secondary spots comprise a row on each side at the outer ends of the ventrals.

Both paratypes are probably somewhat faded. The Chihuahua City specimen has obsolete lateral spots obscured by a brown suffusion; in the San Diego specimen the upper lateral series is subcircular and almost as clear as the dorsal series.

In addition to the body blotches, of which *expolita* has fewer than *philipi*, it may be observed that, in 5 counts out of 6, the sixth infralabial is the largest of the series, whereas the seventh is usually the largest in *philipi*, as is the case in the other subspecies. It will be of interest to observe whether this difference will be maintained when additional specimens of *expolita* become available.

Relationships with Other Subspecies.—The probable intergradation of *expolita* with *philipi* has already been mentioned. That there may be intergradation between *expolita* and *elegans* is also possible; it may be significant that the two specimens from Coahuila, tentatively assigned to *elegans*, are low in both ventrals and body blotches, thus showing a trend toward *expolita*, from which they differ in having 31 scale rows, while the latter has 27.

Life History Notes.—One of the three available specimens of this subspecies had eaten a small mammal.

Range and Locality Records.—This subspecies is only known from three specimens from western and east-central Chihuahua, Mexico, the localities being Casas Grandes, San Diego, and Chihuahua (city).

Arizona elegans noctivaga subsp. nov.

ARIZONA GLOSSY SNAKE

1875. *Pityophis elegans* (part) Yarrow, 100th Mer. Surv., vol. 5, p. 541.
1882. *Pityophis catenifer* var. *deppei* (part) Garman, Mem. Mus. Comp. Zoöl., vol. 8, no. 3, p. 151.
1888. *Arizona elegans* (part) Bocourt, Miss. Sci. Mex., Rept., p. 676.
1894. *Pituophis elegans* (part) Günther, Biol. Cent.-Amer., Rept., p. 125.
1894. *Coluber arizonae* (part) Boulenger, Cat. Snakes Brit. Mus., vol. 2, p. 66.
1900. *Rhinechis elegans* (part) Cope, Rept. U. S. Nat. Mus. for 1898, p. 862.
1924. *Arizona elegans occidentalis* (part) Blanchard, Occ. Papers Mus. Zoöl., Univ. Mich., no. 150, p. 1.

Type.—No. 34188 in the collection of LMK. Found crossing the road 8 miles northwest of Owlshead, Pinal County, Arizona (Owlshead is on U. S. 80, 45 miles southeast of Florence), by Charles E. Shaw and L. M. Klauber, at 9:20 p. m., May 31, 1941. Preserved June 16, 1941.

Diagnosis.—*Noctivaga* is a subspecies belonging to the short-tailed group, with body blotches slightly more extensive than the spaces which separate them, and usually with 27 scale rows. It has fewer scale rows than *elegans* or *blanchardi*, has more ventrals and a shorter tail than *philipi* or *expolita*, and more body blotches than *pacata*. From *eburnata* and *candida* it may be distinguished by the relative longitudinal extents of the dorsal blotches and interspaces; in *noctivaga* the blotches exceed the spaces between, while the contrary is true of the others. Although *noctivaga* is territorially separated from *occidentalis* by the interposition of *eburnata*, they are superficially much alike and I know of no single character which will invariably separate them. *Noctivaga* has fewer ventrals on the average, fewer body blotches, and is usually lighter on the sides, with less regular secondary spots, and with the lower lateral scale rows freer both of spots and the brownish ground-color suffusion. It also lacks the brown marks on the lower labials which usually characterize *occidentalis*, although not those from the San Joaquin Valley.

Description of the Type.—The type specimen is a young adult male; length over-all 829 mm.; tail length 106 mm; tail proportion 12.8 per cent. These measurements were made before the specimen had been hardened in preservative.

The head is slightly convex on top when viewed from the side; from above it is little wider than the neck. The snout is somewhat pointed and the lower jaw inset. The pupil appears round in the preserved specimen.

The scales of the head are normal. The rostral is sharply recurved, wider than high, and convex below. It contacts the first supralabials, the anterior nasals (rather narrowly), and the posterior point separates the internasals for half their lengths. The internasals are longer than wide and curve down in front along the anterior nasals. The prefrontals are quadrangular in shape, with their post-lateral points curved well down over the canthus rostralis. The frontal is pentagonal, narrowing along the supraoculars and then coming sharply to a point between the parietals. The supraoculars are narrowly in contact with the prefrontals; they widen posteriorly, but do not jut over the eyes. The parietals are large and touch somewhat over half the posterior edges of the upper postoculars. The postnasal is considerably larger than the anterior; the nostril is at the upper end of the separating suture, which is not complete at the point where the nasals touch the internasals. Of the supralabials, the postnasal touches both the first and second. There is a single loreal on the right side about twice as long as high, touching the second and third supralabials. On the left the loreal is split vertically. The posterior end of each loreal is somewhat pointed and indents the lower part of the preocular, there being one of the latter on each side. The postoculars are 2–2, the lower being somewhat the smaller. The temporals are 2+3. The supralabials are 8–8, the fourth and fifth touching the eye, and the seventh much the largest. The mental is small and subtriangular. The infralabials are 13–13, the first in contact behind the mental, and the seventh much the largest. There are two pairs of genials, the anterior considerably the longer and fully in contact medianly; the posterior

shorter and thinner, slightly divergent, and separated by two to four rows of gulars.

The dorsal scale rows are 29–27–19, the highest number being found only for a short distance on the neck. The scales are smooth, rather narrow and with rounded ends; the lowest lateral row is the widest. There are single apical scale pits; however, these are quite small and faint. The ventral scales number 213; the anal plate is entire; the subcaudals 49, all divided.

The head is buff, the supralabials being somewhat lighter than the top of the head. There is a faint brown bar across the posterior edges of the prefrontals; another along the suture between the parietals, and another at the outer edge of each parietal. There is a dark streak from each eye back to the angle of the jaw. The lower surface of the head is immaculate cream-colored.

The body pattern comprises a series of 66 rather irregular brown blotches on a buff background. The first blotch on the neck is much longer than the others and is divided longitudinally. The remaining blotches are wider than long and are frequently irregular, since the two halves on the sides are not exactly opposite. Often two on one side match with a single on the other, and several are diagonal rather than transverse. At mid-body the blotches are about 2 scales long, end to end, and 11 scale rows wide, across the body. The interspaces occupy about 1 scale. The blotches are irregularly dark-edged. The ground color is clearly evident only on the three middorsal scale rows. Outside of these the dorsum is suffused with brown, thus somewhat obscuring the outer ends of the main blotches, but the two lowest lateral scale rows are clear. In addition to the main blotches there are two auxiliary series of brown spots on each side. These are quite indefinite, being somewhat obscured by the brownish lateral suffusion; nor do they synchronize perfectly with the main series. The lower and smaller comprises merely a series of scattered black dots, or black scale-edges, the lowest of which touch the second scale row above the ventrals. The ventrum is immaculate cream-color. There are about 20 irregular spots on the tail, evident mostly as darkened scale-edges. The posterior spots are divided into two lateral series by a light longitudinal stripe of the ground color.

Paratype Series.—Noctivaga is sufficiently uniform so that I shall not separately summarize a paratype series, as was done with several of the other new subspecies, but shall consider all the available specimens to be paratypes.*

*These paratypes are AMNH 63640 41 mi. nw. of Safford, CHAS 10024 4 mi. n. of Pima, CHAS 10025 3 mi. s. of Safford (Graham Co.); LMK 27177 13 mi. n. of Tucson, LMK 27178 4 mi. n. of Sahuarita, LMK 29222 Tucson, LMK 32293 Martinez Hill, LMK 32521 11 mi. s. of Tucson, LMK 33714 2 mi. ne. of Tanque Verde Ranch, LMK 34018 14 mi. n. of Tucson, SDSNH 13724 Tucson, SDSNH 17949 11 mi. n. of Tucson, SDSNH 17950-1 4½ mi. n. of Tucson, SDSNH 17952 2 mi. n. of Tucson, KU 14137 16 mi. s. of Tucson (near Sahuarita), AMNH 3807 Tucson, AMNH 26015 Pima Co., AMNH 60561 5 mi. e. of Tucson, AMNH 60669 Rillito, CHAS 11111 and 11228 Marana (Pima Co.); USNM 8002 Camp Grant, LMK 34438 7 mi. se. of Globe, CHAS 9521 6 mi. ne. of Globe (Gila Co.); LMK 21492-3 Picacho, LMK 27180 Florence, LMK 32323 8 mi. w. of Casa Grande, LMK 34104 3 mi. w. of Superior, LMK 34332 Oracle

Material.—The material for study, made up of the type and paratypes, is distributed as follows, all being from Arizona: Graham County 3, Pima County 20, Pinal County 19, Gila County 3, Yavapai County 4, Maricopa County 19, Mohave County 2, Yuma County 1; total 71. Other specimens from Yuma County are either *noctivaga-eburnata* intergrades, or *eburnata*, and are included under the latter subspecies. Of the specimens of *noctivaga* there are 49 males and 16 females, the other 6 being heads or otherwise indeterminate.

Description of Subspecies.—This is a snake of ordinary colubrid proportions, neither heavy-bodied nor slim. The head is only slightly distinct from the neck. Viewed from above the head is wedge-shaped but with a rounded snout. From the side the top of the head is slightly convex. The snout is moderately pointed; the underside slants upward, so that the apex is toward the upper end of the rostral. The eyes are rather protuberant; the diameter of the orbit is about equal to 70 per cent of the distance from the anterior edge of the orbit to the nostril. The pupil appears round in most preserved specimens but is slightly elliptical in life.

The longest available specimen is a male from Phoenix, Arizona, measuring 1051 mm. The smallest specimen measured 272 mm. The tail proportion (ratio to length over-all) varies from 12.2 to 15.2 per cent in the males, and from 11.6 to 13.3 per cent in the females. The averages are respectively 13.7 and 12.7 per cent.

The body is covered with smooth scales, rather narrow and with slightly rounded ends. The lower lateral rows are moderately enlarged. Single apical scale pits are faintly evident on a few scales.

The scale rows at mid-body are usually 27, but 13 per cent of the specimens have 29, and one specimen has only 25. The ventrals in the males vary from 204 to 214, interquartile range 207.0 to 210.6, mean 208.80∓.39, coefficient of variation 1.27 per cent; the over-all range in the females is from 211 to 224, interquartile range 216.7 to 221.7, mean 219.19∓.69, coefficient of variation 1.72 per cent. The anal is entire. The subcaudals, all divided, vary from 46 to 52 in the males, the interquartile range being 48.1 to 50.1, mean 49.09∓.21, coefficient of variation 2.96 per cent. In the females the over-all range is 43 to 48, interquartile range 44.3 to 46.5, mean 45.40∓.42, coefficient of

Junction, CAS 80685 Florence Junction, CAS 80699 4 mi. n. of Ajo, CHAS 9404 10 mi. nw. of Sacaton, CHAS 9920 5 mi. w. of Superior, CHAS 10290 6 mi. w. of Florence, CHAS 10291 5 mi. w. of Florence, CHAS 10292 3 mi. s. of Florence Junction, CHAS 10293 1 mi. s. of Florence Junction, CHAS 10294 5 mi. w. of Florence, CHAS 10295 4 mi. s. of Florence Junction, CHAS 11112 25 mi. se. of Florence, CHAS 11113 10 mi. se. of Chandler (Pinal Co.); LMK 23925-6 Sentinel, LMK 25829 Mesa, LMK 26010 Mesa, LMK 26913 5 mi. s. of Wickenburg, LMK 26943 Cactus Gardens, LMK 32781 Gila Bend, LMK 34331 Stanwix, AMNH 8352 and 9021 Phoenix, USNM 44259 Phoenix, CHAS 3082 1 mi. n. of Wickenburg, CHAS 3386 2 mi. n. of Wickenburg, CHAS 3661 4½ mi. s. of Wittman, CHAS 12246 Phoenix, SDSNH 15835 Sentinel (Maricopa Co.); SDSNH 17623 1 mi. s. of Congress Junction, CHAS 2083 4 mi. n. of Wickenburg, CHAS 3084 10 mi n. of Wickenburg, CHAS 3705 6 mi. n. of Congress Junction (Yavapai Co.); USNM 37112 mesa n. of Ft. Mohave, MVZ Boulder Lake (Mohave Co.); LMK 34526 5 mi. e. of Salome (Yuma Co.).

variation 3.60 per cent. The coefficient of sexual divergence in the subcaudals is 7.8 per cent. The terminal scale is somewhat elongated, with a lateral crease.

The head scales do not diverge from the colubrid normal in size and arrangement. The rostral is rather sharply curved, both over the top of the snout and below, where it is hollowed longitudinally. It is about 20 per cent wider than high. The upper point separates the internasals for about half their lengths; in addition it contacts the prenasals and the first supralabials. The internasals are longer than wide and curve downward to a point in front of the prenasals. The prefrontals are wider than high and curve down over the canthus rostralis to a level with the center of the eye. The supraoculars are narrow and elongated; they barely touch the prefrontals and widen posteriorly, where they contact the parietals and upper postoculars. The frontal narrows posteriorly; it separates the parietals for a short distance. The parietals are the largest of the head scales; the dorsal scales which border them are somewhat enlarged and irregular. The prenasal is much smaller than the postnasal. The nostril is at the upper end of the suture which divides the nasals; it slants forward above. The nasals are not separated above the nostril, being connected by a narrow ridge. The postnasal usually contacts the first and second supralabials. The loreal is twice as long as wide, and is highest forward, becoming pointed posteriorly, especially where it touches the preocular. The loreal contacts the second and third supralabials. Divided loreals are more frequent in this subspecies than any other, being present in 10 counts out of 132. The preoculars are usually single, although paired in 9 counts out of 132. The preoculars are somewhat wider above than below. The postoculars ordinarily number 2, and are subequal in size; there are 3 in 2 counts out of 132. The temporals are usually 2+3 or 2+4, but vary from 1+2 to 3+6. Those in the first row are usually elongated, slanting upward posteriorly. The supralabials are most often 8, but number 9 in 8 per cent of the counts. The fourth and fifth contact the eye; the next to the last is always much the largest. The infralabials vary from 11 to 14, the distribution being 11(1), 12(20), 13(93), 14(10). The first pair meet on the median line. Usually the seventh is the largest of the series, although it may be the eighth if there are 14. The mental is small and triangular. The anterior genials are large and contact on the median line; the posterior are both slimmer and shorter, and, diverging posteriorly, are separated by from 2 to 5 rows of gulars.

Noctivaga is a brown snake with dark-brown blotches down the back, and additional secondary blotches on the sides, which, however, are somewhat obscured by a lateral suffusion of brown. In general, *noctivaga* falls between the usually darker *occidentalis* on the one hand, and *eburnata* and *candida*, which are lighter, on the other.

The head is brownish on top, and somewhat lighter on the sides, especially along the supralabials. There is a brown band, darker than the ground color, on the posterior edges of the prefrontals; also dark-brown spots on the supraoculars, frontal, and parietals, often concentrated along the sutures which separate these plates. There is a brown streak passing backward from

the orbit to the angle of the mouth; also, there is often a brown mark below the eye and another at the anterior end of the loreal. The lower jaw is usually immaculate, although the posterior infralabials are sometimes marked by a continuation of the postocular dark streak. All the head marks are much clearer in the young than the adults.

On the neck there is usually a pair of parallel dark marks separated by a light streak. These, the first of the dorsal series, may be joined together anteriorly, posteriorly, or both.

The dorsal blotches occupy somewhat more longitudinal space than the interspaces which separate them. The interspaces equal the blotch lengths in only 3 specimens out of 61; in all the others the blotches are longer. This is sharply different from *eburnata* and *candida*, in which the contrary is true in nearly every specimen. The body blotches vary in number from 52 to 67, interquartile range 56.2 to 60.8, mean 58.48∓.42, coefficient of variation 5.9 per cent. The tail spots have an over-all range of 15 to 23, interquartile range 17.1 to 19.6, mean 18.32∓.25, coefficient of variation 10.3 per cent. The body blotches at mid-body usually (70 per cent) cover 11 scale rows across the body, but a few range from 8 to 13 rows. The longitudinal extent of the blotches, again measured at mid-body, varies from 1½ to 2½ scales, end to end, but most specimens cover 2 scales. The interspaces are somewhat narrower; most of them are 1½ scales in length, but the variation is from 1 to 2 scales. The lateral brown suffusion is usually carried down to the second to fourth row above the ventrals. The lateral spots of the auxiliary series usually are not present below the second scale row above the ventrals.

The body blotches, although ordinarily elliptical, with the major axis transverse, are often quite irregular because the blotches on one side do not fall exactly opposite those on the other. This results in some diagonal blotches, and others which are restricted to one side, while still others are Y-shaped.

In addition to the main dorsal blotches, there are, on each side, two or more alternating series of progressively smaller spots. These are more perfect anteriorly. The first of these series comprises subcircular, or vertically elongated, spots, alternating with the dorsal series, and is rather regular; those below are hardly more than scattered darkened scale-edges.

The main dorsal blotches are brown, with dark-brown or black edges. Between blotches the ground color is buff, but this is evident only on 3 to 5 middorsal scale rows, and on the lowest lateral rows, for dorso-laterally the area between blotches is heavily suffused or punctated with brown. This darkening as accentuated on the scale centers; the scale edges are usually light, giving a net-work effect characteristic of *Arizona*. The lateral darkening tends to obscure the outer edges of the middorsal blotches and the lateral series as well; in some specimens the lateral suffusion is so dense as almost to blot out the side blotches completely. This side-darkening increases with age; juveniles are usually quite clear between blotches. The ventrum is immaculate cream.

The following colors were noted on a live specimen from Mesa, Maricopa County, Arizona, using Ridgway's Color Standards, 1912, for comparisons:

Centers of blotches, middorsally, Sayal Brown; centers of blotches, laterally Snuff Brown; edges of blotches, Black; center of scales in lateral interspaces, Verona Brown; middorsal interspaces, Light Pinkish Cinnamon; ventral surface, Pale Olive Buff.

Intrasubspecific Trends.—Noctivaga seems to be rather consistent throughout its range, and it will take larger series than are yet available to determine the presence of clines in the characters. There appears to be a slight reduction in the average number of ventrals from west to east, and a small increase in body and tail spots.

Relationships with Other Subspecies.—The possible intergradation of *noctivaga* and *philipi* has already been discussed. In Yuma County *noctivaga* undoubtedly intergrades with *eburnata.* The snakes of the Yuma–Somerton–Gadsden area are probably pure *eburnata,* the only territory east of the Colorado River inhabited by that subspecies, so far as is now known. The area of intergradation between *noctivaga* lies to the east of the Gila Mountians, from Wellton to the vicinity of Sentinel in southwestern Maricopa County. Here there is a gradual change from the one form to the other.

Along the Colorado River north of Ehrenberg, and as far north as Boulder Dam, a lack of specimens prevents any exact knowledge as to the boundary between the subspecies. The few specimens that are available indicate the river to be the boundary, for those on the east side are *noctivaga* and those on the west *eburnata.*

Life History Notes.—Noctivaga, as the name implies, is nocturnal; this is shown by the following evening times of collection: 8:30, 9:20, 9:33, 9:40, 9:50 (2), 10:10, 10:37, 10:45, 11:00, 11:25, 11:30, 11:40. I have no daytime collection records. The following air temperatures in degrees F. were noted when specimens were found alive on the road: 70, 72(2), 78(2), 85(2), 86, 90. These records were secured by using the scheme of collecting which has proved so successful in the deserts of the southwest—by driving on paved roads at night. I think the best success has been attained where the roads are bordered by creosote bushes—for example, on the mesa above Tucson on the Florence road, about Florence Junction, and near Wickenburg. Other surroundings where specimens have been found were as follows: Fields (cultivated), grass, mesquite, brushy desert, rocky desert.

Ortenburger and Ortenburger (1926, p. 116) found a specimen at 10 p. m. near a temporary mud puddle, through which it attempted to escape, swimming readily as if accustomed to water.

While *noctivaga* appears almost white in the glare of auto headlights against the black background of a paved road, the type specimen was collected on a dirt road and appeared darker than its background.

As in the other subspecies, the food comprises small mammals and reptiles; mammal hair was found in one specimen, and lizard scales in another. A photograph has been seen of a specimen, probably of this subspecies, which had died in attempting to swallow a horned toad.

This subspecies reaches an altitude somewhat in excess of 3500 ft. at Globe, and elsewhere along the mountain fringes from Kingman southeast to Safford.

Range.—Arizona west and south of the central mountains, but excluding the Yuma Mesa and Yuma Desert; also excluding Cochise County.

Locality Records.—

ARIZONA

MOHAVE COUNTY:
East shore of Lake Mead (= Boulder Lake)
Mesa s. of Fort Mohave
Louise
10 mi. w. of Oatman

YUMA COUNTY:
Brenda
5 mi. e. of Salome

MARICOPA COUNTY:
Stanwix*
Sentinel*
Gila Bend (also 10 mi. e.)
Wickenburg (also 1 and 2 mi. n., 4 mi. e., 5 mi. s., and 3, 6, and 10 mi. w.)
4 mi. s. of Wittman
Cactus Garden
Phoenix
Mesa

YAVAPAI COUNTY:
Congress Junction (also 6 mi. n. and 1 and 5 mi. s.)
4, 6, and 10 mi. n. of Wickenburg (Maricopa County)

GILA COUNTY:
6 mi. ne., and 6 and 7 mi. se. of Globe

GRAHAM COUNTY:
Camp Grant
41 mi. nw. of Safford (near Calva)
4 mi. n. of Pima
Thatcher
3 mi. s. of Safford

PINAL COUNTY:
Superior (also 3 and 5 mi. w.)
Florence Junction (also 1, 3, and 4 mi. s.)
Florence (also 5 and 6 mi. w., and 25 mi. se.)
10 mi. se. of Chandler (Maricopa County)
10 mi. nw. of Sacaton
Casa Grande (also 8 mi. n. and 12 and 6 mi. w.)
Picacho
8 mi. nw. of Owlshead (type locality)
Oracle Junction

PIMA COUNTY:
4 mi. n. of Ajo
Marana
Rillito
10 and 11 mi. s. of Oracle Junction (Pinal County)
Tucson (also 2, 4, 5, 8, 11, and 13 mi. n., 5 mi. e., and 11 and 16 mi. s.)
Martinez Hill
2 mi. ne. of Tanque Verde Ranch
Rita
Sahuarita (also 4 mi. n.)

Arizona elegans eburnata subsp. nov.

DESERT GLOSSY SNAKE

Plate 8, fig. 1

1892. *Rhinechis elegans* (part) Cope, Proc. U. S. Nat. Mus., vol. 14, no. 882, p. 638.

1897. *Arizona elegans* (part) Van Denburgh, Occ. Papers Cal. Acad. Sci., no. 5, p. 193.

1924 *Arizona elegans occidentalis* (part) Blanchard, Occ. Papers Mus. Zoöl., Univ. Mich., no. 150, p. 1.

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* *Noctivaga-eburnata* intergrades.

Type.—No. 33094 in the collection of LMK. Taken at Bensons Dry Lake, in eastern San Diego County, California (3 miles west of the Imperial County Line on highway Cal. 78), by James Deuel. Preserved June 5, 1940.

Diagnosis.—A desert subspecies characterized by small and narrow blotches, light color, and high ventral scale counts. It differs from all others except *candida* in having blotches markedly shorter than the interspaces which separate them. Other differences are as follows: From *elegans* and *blanchardi* it differs in having fewer scale rows and subcaudals; from *occidentalis* in its lighter color, narrower blotches, and immaculate infralabials and lower lateral scale rows; from *noctivaga* by its narrower blotches; from *philipi* and *expolita* by its greater number of ventrals and relatively shorter tail; and from *pacata* by its greater number of body blotches. *Eburnata* can be segregated from *candida* since it has only one preocular, while the Mojave Desert form generally has two; also, the dorsal blotches of the latter usually engage 9 scale rows compared to 7 in *eburnata.*

Description of the Type.—The type specimen is a young male; length over-all 671 mm.; tail length 94 mm.; tail proportion 14.0 per cent. These measurements were made before shrinkage in preservative.

This is a snake of moderate body shape, neither racer-like nor particularly stout. The head is rather narrow and little distinct from the neck. The snout is pointed, sloping backward below, with the lower jaw inset. The pupil is almost round although slightly narrower than high.

The scales of the head are normal. They comprise a sharply recurved rostral, twice as wide as high, and strongly indented below. The posterior point separates the internasals for about half their lengths. The rostral contacts the prenasals as well as the first supralabials. The internasals are longer than wide, with anterior points curving down over the canthus. The prefrontals are quadrangular in shape, wider than long, and with their postlateral points curved well down over the canthus. The frontal is hexagonal, longer than wide, narrowing somewhat along the supraoculars, and then coming quickly to a point between the parietals. The supraoculars are narrowly in contact with the prefrontals; they widen somewhat posteriorly. The parietals are large and touch over half the posterior edges of the upper postoculars. Medianly the parietals are edged by normal dorsal scales. The suture between the nasals is not complete on either side above the nostril, which is near the upper end of the suture. The prenasal is much smaller than the postnasal; it is triangular in shape. The postnasal touches the first and second supralabials. There is a single quadrangular loreal on either side about twice as long as high, touching the second and third supralabials. It has a lower posterior point which indents the lower half of the preocular. There are one preocular and two postoculars, the latter being about equal in size. The temporals are 2+3. The supralabials are 8–8, the fourth and fifth touching the eye, and the seventh largest. The mental is small and triangular. The infralabials are 13–13; the first on each side are in contact behind the mental; the seventh is much the

largest. There are two pairs of genials, the anterior considerably the longest, and medianly in contact; the posterior are separated by several gulars.

The dorsal scale rows are 27–27–18. The scales are smooth, rather narrow and with slightly rounded ends. Single apical scale pits are faintly evident on some scales, particularly caudad. The ventral scutes number 224; the anal plate is entire; there are 54 subcaudals, all divided.

The head is buff above, with a dark line across the posterior edges of the prefrontals; there are dark spots on the posterior edge of the frontal, and along the suture separating the parietals. The sides of the head are cream-colored; there is a dark streak from the eye back to the last supralabial, and also below the eye in the suture between the fourth and fifth supralabials. The lower surface of the head is cream-colored and unspotted.

The body pattern comprises about 76 irregular, and rather ill-defined light-brown blotches, on a cream-colored background. The blotches are accentuated by dark posterior scale-edges. They are much wider (across the body) than long. At mid-body they are about 1 scale long, and 7 scale rows wide. The interspaces entail about 2½ scales (end to end). On the neck there is a pair of parallel blotches about 7 scales long. The irregularity of the dorsal blotches is such that in some places the blotches are diagonal, while in others there are separate spots on each side. The ground color is most clearly evident on the three middorsal scale rows; the next 9 rows on either side are centrally punctated with buff, causing a suffusion which tends to obscure the lateral edges of the main blotches. Some of this suffusion is faintly evident down to the third lateral row above the ventrals. Scattered through this suffused lateral area there are irregular black spots, none of which is large enough to cover an entire scale. These are the residual posterior edges of what, in the more easterly subspecies, are secondary lateral blotches. The lowest of these spots mark the third scale row above the ventrals, the two lowest rows on either side being immaculate, as is the ventrum. This is cream-colored in preserved specimens, but white in life. The tail spots are highly irregular, and absent dorsally. There are about 22, but they cannot be counted with certainty.

Summary of Paratypes.—There are available from the type locality, or its immediate vicinity in the Borego area of eastern San Diego County, 40 specimens of this subspecies. Since these exhibit certain differences from the subspecies as a whole, which shows some variation throughout its range, it is deemed desirable to designate these as paratypes and to summarize their characteristics separately.*

* These specimens and their locations are as follows: LMK 4454, 23854, 23914-5, 25437-8, 26914, 26939-42, 27308, 27383, 27405, 29300, 33094-5, SDSNH 17026, and CNHM 26036 all topotypes from Bensons Dry Lake; LMK 23024, 23774-6, 23852-3, 26814, 29301, 29487, 32035 from The Narrows, LMK 4862 Beatty Ranch (Borego Valley), LMK 5136, 21108, 21121 Borego Valley, LMK 23773 5 mi. e. of The Narrows, LMK 26732 2 mi. s. of Borego P. O., LMK 27331 3 mi. w. of Bensons Dry Lake, LMK 26056-7 Borego Palm Canyon, UCLA 548 San Felipe Wash (6 mi. w. of Imperial Co. line), and UCLA 552 1 mi. w. of Imperial Co. line (= 2 mi. e. of Bensons).

There are 25 males (including the type) and 16 females. Twenty-seven scale rows comprise the mode, 27 specimens having this number; one has 25, 3 have 28 and 10 have 29. The ventrals in the males range from 218 to 227, interquartile range 221.0 to 225.2, mean 223.08∓.63, coefficient of variation 1.41 per cent; in the females the over-all range is 226 to 241, interquartile range 232.1 to 236.9, mean 234.50∓.88, coefficient of variation 1.50 per cent. The subcaudal statistics are, males, range 48 to 54, interquartile range 50.0 to 52.0, mean 51.00∓.30, coefficient of variation 2.83 per cent; females, range 44 to 49, interquartile range 45.5 to 47.4, mean 46.43∓.37, coefficient of variation 3.01 per cent. The supralabials are distributed thus: 7(1), 8(74), 9(7); and the infralabials 11(1), 12(14), 13(63), 14(4). The loreals are single in all specimens; there are two preoculars in 4 counts out of 82 (4.9 per cent) the rest having single preoculars; all specimens have two postoculars.

The body blotches vary from 58 to 82, interquartile range 64.4 to 72.4, mean 68.41∓.93, coefficient of variation 8.66 per cent; the statistics of tail spots are, over-all range 16 to 26, interquartile range 18.1 to 21.7, mean 19.90∓.43, coefficient of variation 13.4 per cent.

The paratypic series well illustrates the outstanding pattern characteristics of this subspecies—the light color, narrow and short dorsal blotches, wide interspaces and unmarked lower lateral scale rows. The variations in width of the dorsal blotches at mid-body, measured by the number of scale rows covered, is as follows: 6(5), 7(26), 8(7), 9(3). The longitudinal extent of the dorsal blotches is usually a single scale (21 out of 42 specimens) although it may reach 1¼ or 1½, and in two specimens attains 2 scales (end to end). The interspaces usually measure 2 scales (end to end), but vary from 1¾ to 3. The brownish side suffusion generally terminates on the second or third scale row above the ventrals; in no case does it reach the lowest row. Also, the obsolescent auxiliary lateral blotches, represented in this subspecies by darkened scale tips, usually end on the third row above the ventrals, although the lowest row reached varies from the second to the fifth.

The tail proportion varies between 12.2 and 14.5 per cent in the males, and from 11.0 to 13.3 per cent in the females. Most adult males fall between 12.8 and 14.2, and the females from 12.2 to 12.7 per cent.

Material.—In addition to the type and paratypes from eastern San Diego County, totaling 41 specimens, the following are available: California, San Diego County 44 (including some *occidentalis* intergrades), Imperial County 13, Riverside County 51, San Bernardino County (east of the Mojave Desert, together with the Twentynine Palms-Morongo section, several of which are *candida* intergrades) 14; Nevada, Clark County 8, Nye County 1; Utah, Washington County 4; Arizona, Yuma County 13 (including some *noctivaga* intergrades); Sonora 2; grand total 191. There are 125 males and 62 females, the others being heads or indeterminate.

Description of the Subspecies.—This is a snake of ordinary colubrid proportions. The head is slightly distinct from the neck. Viewed from above the

head is wedge-shaped with a rounded snout. From the side the top of the head is slightly convex or flat; the jaw is deeply inset. The apex is moderately pointed; the forward part of the snout slants upward, the tip being toward the upper end of the rostral. The eyes are somewhat protuberant; the diameter of the orbit is about 70 per cent of the distance from the anterior edge of the orbit to the nostril. The pupil appears round in most preserved specimens but is somewhat vertically elliptical in life.

The longest specimen I have had, a female from Mecca, Riverside County, measured 1147 mm. The smallest specimen measured 213 mm. The tail proportion (ratio to length over-all) varies from 12.0 to 15.5 per cent in the males, and from 11.0 to 14.1 per cent in the females. The averages are respectively 13.7 and 12.6 per cent. The young specimens have slightly shorter tails, proportionately, than the adults.

In studies of tail length (Klauber, 1943, p. 5) I gave the following equations for *Arizona* (Table 9):

*Eburnata**	males	$T = 0.132L + 1.85$
	females	$T = 0.131L - 5.53$
Candida†	males	$T = 0.143L - 2.63$
	females	$T = 0.133L - 3.40$

where T is the tail length and L the length over-all, both in millimeters.

It will be observed that the equation for the ontogenetic curve of male *eburnata* is inconsistent with the others, in that the proportionate tail length is greater in the juveniles than the adults, whereas in the others, the constant term being negative, the contrary is true. After noting trends in other subspecies in the course of the present study, I am of the opinion that the particular sample available to me produced an erroneous result, and that the regression line in male *eburnata* probably falls close to

$$T = 0.14L - 2.0$$

Measurements were made of the head lengths of a number of specimens of *eburnata*, and it was found, as is usually the case, that the proportionate size of the head decreases slightly with age. A straight line fairly well defines the relationship with the length over-all, the equation being

$$H = 0.022L + 6.5$$

where H is the head length and L the length over-all, both expressed in millimeters.

The hemipenis is single, although somewhat expanded distally. The inner half is almost covered with tiny points, although less so proximally and on the side opposite the sulcus. At about the middle of the shaft there is a sudden transition to spines which are both much longer and heavier. These completely encircle the shaft, except that they remain fine and delicate along the sulcus. They are densely set and are not in regular rows; about 20 comprise a complete

* Listed as *Arizona e. occidentalis* I.
† Listed as *Arizona e. occidentalis* II.

ring. Distally there is again a diminution in size, so that the smallest spines at the outer end are about equal in size to those on the proximal area of the shaft. At the outer end the organ widens and is truncated irregularly, the end comprising a hollowed surface, at a slight angle with the main axis. This outer end is covered with reticulated flounces. The sulcus turns over the highest part of the outer end and then terminates in a small bare depression. The transition from points to flounces is quite sudden. The sulcus takes a slightly diagonal course up the shaft. Specimens of *occidentalis* show no differences from *eburnata*.

Pituophis catenifer exhibits the following differences in hemipenes from *Arizona elegans eburnata*: In *Pituophis* the proximal half of the shaft is quite smooth, instead of being almost covered with fine points as in *Arizona;* at the outer end in *Pituophis* there is a greater tendency toward bifurcation, and the smooth area within the cleft is relatively more extensive than in *Arizona*.

The body is covered with smooth scales, rather narrow and with rounded ends. The lower lateral rows are somewhat enlarged. Single apical scale pits are present, but they are so faint as to be located with difficulty.

The scale rows at mid-body are usually 27, but are occasionally 29 (15 per cent), and in one specimen 25. The ventrals in the males vary from 208 to 228, interquartile range 216.5 to 222.6, mean 219.54∓.41, coefficient of variation 2.07 per cent; the over-all range in the females is from 220 to 241, interquartile range 229.0 to 233.4, mean 231.21∓.62, coefficient of variation 2.05 per cent. The anal is entire. The subcaudals, all divided, vary from 47 to 59 in the males, the interquartile range being 50.3 to 53.4, mean 51.82∓.21, coefficient of variation 4.36 per cent. In the females the over-all range is 43 to 54, interquartile range 46.1 to 49.4, mean 47.76∓.33, coefficient of variation 5.18 per cent. The coefficient of sexual divergence in the subcaudals is 8.2 per cent. The terminal scale is conical, with a lateral crease; it is not difficult to tell whether the tail is complete. Incomplete tails are not particularly frequent as compared to *Pituophis*, for example.

The head scales are normal in size and arrangement. The rostral is rather sharply curved, both over the top of the snout and below. It is considerably wider than high. The upper point separates the internasals for half their lengths; in addition it contacts the prenasals and the first supralabials. The internasals are longer than wide; they curve down in front of the prenasals. The prefrontals are wider than high; they curve down to a broad contact with the loreals. The supraoculars narrowly contact the prefrontals; in addition they touch the preoculars, postoculars, frontal, and parietals. The frontal is widest anteriorly and terminates posteriorly at a point which does not deeply indent the suture between the parietals. The parietals are the largest of the head scales. They are subtriangular in shape, decreasing in size posteriorly. The dorsal scales which border them are irregularly enlarged. The prenasal is smaller than the postnasal. The nostril is at the upper end of the suture which divides the nasals; it slants forward and upward. The suture is not usually complete above the nostril, being blocked by a ridge which connects the two nasals. The postnasal usually contacts the first and second supralabials. The loreal is about

twice as long as wide, and is highest anteriorly, being pointed sub-posteriorly where it indents the preocular. The loreal contacts the second and third supralabials. One specimen has a divided loreal on one side, and another has no loreal on one side, these being the only 2 aberrants out of 382 counts. The preoculars are usually single, although paired in 11 counts out of 376 (excluding possible *candida* intergrades). The preocular is wider at the prefrontal than the loreal contact. The postoculars ordinarily number 2, and are about equal in size; there are 3 in 10 counts out of 382. The temporals are usually 2+3 or 2+4, but vary from 1 to 4 in the first row and 2 to 5 in the second. Those contacting the postoculars are elongated, and slant upward posteriorly. The supralabials are usually 8, but occasionally number 7 (3 per cent) or 9 (7 per cent). The fourth and fifth contact the eye; the next to the last is always much the largest. The infralabials vary from 11 to 15, with a mode of 13, the distribution being 11(9), 12(84), 13(246), 14(31), 15(1). The first pair meet on the median line. Usually the seventh is the largest of the series, although occasionally it is the sixth. The mental is small and triangular. The anterior genials are large and contact on the median line, while the posterior are both slimmer and shorter, and, diverging posteriorly, are separated by from 2 to 4 rows of gulars.

Eburnata is the lightest of all subspecies of *Arizona;* it is a buff or cream-colored snake with brownish transverse marks on the back, and additional spots on the sides, which may be rather obscured by a lateral suffusion of light-brown punctations.

The head is light-brown or clay-colored above, the sides being somewhat lighter. There is often a brown band on the posterior edges of the prefrontals, but in many specimens it is quite faint. There are usually a few brown spots on the supraoculars, frontal, and parietals, often concentrated along the sutures which separate these plates. There is a brown streak passing backward from the orbit to the angle of the mouth, but in many specimens the posterior part may be absent, or represented by a spot on the last supralabial. Sometimes the suture between the supralabials immediately below the eye is darkened with brown. The lower jaw is immaculate.

On the neck there is usually a pair of parallel dark marks separated by a light streak. These, the precursors of the dorsal series, are rarely joined together anteriorly or posteriorly.

The dorsal blotches occupy much less longitudinal space than the interspaces which separate them. The body blotches vary in number from 55 to 83, interquartile range 64.3 to 72.8, mean 68.54∓.46, coefficient of variation 9.2 per cent. The tail spots have an over-all range of 15 to 29, interquartile range 18.6 to 22.1, mean 20.35∓.20, coefficient of variation 12.9 per cent. The body blotches at mid-body cover from 6 to 10 scale rows across the body, but in most specimens they span 7 to 9 rows, 7 being in the majority. The longitudinal extent of the blotches, again measured at mid-body, varies from 1 to 2 scales, end to end, but most specimens extend from 1 to 1½ scales. The interspaces are always wider (except in *occidentalis* or *noctivaga* intergrades); most of them are from 1½ to 2 scales in length, but in a few specimens reach 2½ or even 3

scales. A lateral brown suffusion is present, usually down to the second to fourth row above the ventrals. The lowest lateral spots of the auxiliary series seldom touch any row below the second, and in many cases the third or fourth is the lowest marked. The relative freedom from marks on the lower lateral scale rows is characteristic of this subspecies.

The body blotches, although generally comprising short bands, with the major axis transverse, are quite irregular, in a considerable proportion of the total, because the spots on the two sides do not synchronize. This results in some diagonal blotches, and others which are restricted to one side while still others are Y-shaped, double on one side and single on the other.

In addition to the main dorsal blotches, there are, on each side, several alternating series of progressively smaller spots. In many specimens these lateral spots approach obsolescence, and are represented only by irregular darkened scale-edges.

The main dorsal blotches are brown, with dark-brown edges; the darker borders are rather irregular. Between blotches the ground color is cream, but this is evident only middorsally and laterally, for elsewhere there is a brownish stippling or suffusion which colors the sides and much reduces the contrast between the blotches and ground color. This darkening is evident particularly in scale centers; the scale edges are usually light, giving a net-work effect characteristic of *Arizona*. There is much variation in the extent of the suffusion dorsally; in some specimens the dorsum is as much colored as the sides, but in others the three middorsal rows may be almost unmarked, so as to constitute a light central streak. Usually, at the tail, the light streak takes precedence over the main dorsal blotches, dividing them into bilateral series. In any case, the tail blotches are often so irregular that they cannot be counted with accuracy. The lowest lateral rows in this subspecies are usually immaculate, differing in this regard from *occidentalis*, in which they are usually both suffused and spotted by the lowest side blotches. The suffusion is less evident in young specimens, on which both the head and body marks are clearer.

A live specimen from Borego Palm Canyon, San Diego County, exhibited the following colors, using the designations of Ridgway's Standards, 1912: Ground color of the head, Avellaneous; postocular streak, Army Brown; centers of dorsal body blotches, Avellaneous; edges of dorsal blotches (quite narrow), Bone Brown; scales of interspaces, middorsally, Pinkish Cinnamon, with White outer edges; lateral blotches, Sepia, (these are really lines, comprising the obsolescent remains of blotches, rather than true blotches); centers of scales in lateral interspaces, Orange Cinnamon; edges of scales in lateral interspaces, White; ventrum, White. The pupil is almost round, although slightly compressed, vertically; the iris is golden. The eye has a considerable freedom of horizontal rotation; it can be directed toward the front or rear. The tongue is black, with whitish tips.

Intrasubspecific Trends.—In the subspecies *eburnata* the ventral scutes reach a maximum in the Borego area of eastern San Diego County, declining both to the north and east. But a contrary trend is evident in the subcaudals,

which tend to increase in Riverside, as compared to San Diego County; and the tendency continues northward across the eastern Mojave Desert into southern Nevada and southwestern Utah. The infralabials are also higher in Riverside County.

The blotches, both body and tail, are highest in the Coachella-Palm Springs area of Riverside County, falling off to the north, east, and south. But the blotches are most highly differentiated from the other subspecies in the Borego area of San Diego County, for here they are narrowest both along and across the body. Likewise, more of the lower lateral scale rows are unmarked.

The tail length ratio increases from the type locality toward Riverside County, and remains higher into Nevada and Utah. The Nevada-Utah snakes are less highly differentiated from *occidentalis* than are the specimens of the western Colorado Desert. It is possible that the availability of additional material from Utah might validate other differences, and thus substantiate the further segregation of the snakes of that area into a new subspecies.

Relationships with Other Subspecies.—I have already mentioned the intergradation of *eburnata* with *noctivaga* in eastern Yuma and western Maricopa counties, Arizona. Intergradation with *candida* will be discussed under that subspecies.

Eburnata intergrades with *occidentalis* along the eastern slope of the San Jacinto and Peninsula ranges in Riverside and San Diego counties, California. Intergradation evidently occurs wherever the mountain ranges are low enough for *Arizona* to cross. In the San Gorgonio Pass the intergrades are found in the vicinity of Cabazon. In eastern San Diego County the specimens found in the San Felipe Valley are intermediate and are to be deemed intergrades; and even as far out on the desert as Yaqui Well they are not yet typical *eburnata*. In Warners Ranch the snakes are typical *occidentalis*. Farther south, at Jacumba, they are intermediate, favoring slightly the desert subspecies. The same intergradation no doubt occurs across the Sierra Juárez in Baja California, Mexico, but no specimens are available from the east side of the mountains in that territory.

Life History Notes.—*Eburnata* occupies the largest area of any of the truly desert subspecies of *Arizona*. It is found in a variety of surroundings, from an almost barren desert, or sand dunes, to places where the brush cover is quite dense. While not absent from rocky areas, it does not prefer them, and is less plentiful in such situations than on the sandy flats. Some of the surroundings where this subspecies has been observed have been as follows:

Orchard	1
Cultivated field	5
Grass	1
Light brush	2
Heavy brush	3
Cactus	1

Mesquite	2
Joshua trees	1
Rocks	1
Rocky desert	1
Brushy desert	21
Sandy desert	8
Total	47

Mosauer (1935, p. 20) found a specimen in sand dunes at 10 p. m. after following the tracks for 200 feet. Cowles and Bogert (1944, p. 285) consider *Arizona* a true burrowing snake, which flows in and out of loose desert soil with little difficulty. I believe that *eburnata* takes refuge either by burrowing, or in mammal holes, which are plentiful in most desert areas. The late Frank Stephens plowed out a specimen at La Puerta, February 10, 1923. Cowles (1941, p. 134) reports a specimen excavated by a scraper February 20, which he judges to have been concealed just below the surface of the ground. At San Felipe on March 11, 1929, one was found beneath a stone.

Eburnata reaches an altitude of about 2800 feet in southwestern Utah and in eastern San Diego County. But the most typical habitats are at lower levels, especially in the Salton Basin, where this subspecies occurs down to 240 feet below sea level. In the Imperial Valley, *eburnata* does not seem to have been greatly affected by irrigation; it has neither been driven out, as have such desert forms as *Crotalus cerastes laterorepens* and *Chionactis occipitalis annulatus*, nor has it greatly increased in numbers as has been the case with *Pituophis catenifer affinis* (Klauber, 1939, p. 52).

That *eburnata* is nocturnal can be readily shown by a list of the hours when specimens have been encountered alive on the road:

Time	*Number of Specimens*
6:00 to 6:29 p. m.	1
6:30 to 6:59	1
7:00 to 7:29	5
7:30 to 7:59	5
8:00 to 8:29	7
8:30 to 8:59	9
9:00 to 9:29	6
9:30 to 9:59	5
10:00 to 10:29	6
10:30 to 10:59	6
11:00 to 11:29	2
11:30 to 11:59	2
3:30 to 3:59 a. m.	2
Total	57

The only specimen found in the daytime was lying in a bush at Las Arenas, San Felipe Valley, San Diego County, at 3:15 p. m. This was an *occidentalis* intergrade.

Linsdale (1940, p. 243) reports a specimen motionless on the ground a half hour before sunset. Cowles (1941, p. 133) mentions a specimen basking in the sun near Indio, California, in December. Cowles and Bogert (1944, p. 285) found *Arizona* to be secretive in captivity, appearing on the surface only rarely and for short intervals. There was an avoidance of light. Nevertheless, a large gravid female was found abroad in the Coachella Valley at 8 a. m. on July 7, 1940, in full sunlight, although the temperature probably exceeded 100 degrees F. in the shade. This individual was evidently seeking a place to deposit eggs; they were laid the following day and eventually hatched.

The air temperatures when *eburnata* has been observed active on the road at night have been as follows:

Temperature Deg. F.	*Number of Specimens*
64–65	1
66–67	0
68–69	1
70–71	2
72–73	1
74–75	4
76–77	4
78–79	1
80–81	6
82–83	1
84–85	2
86–87	5
88–89	2
90–91	2
Total	32

Eburnata does not have to withstand quite as low temperatures in its season of maximum activity in the Colorado Desert, as does *candida* in the western Mojave Desert. From seasonal and mileage statistics (Klauber, 1939, p. 44), it is believed that *eburnata* is most active in late May or early June, earlier in the lower Colorado Desert (the Salton Basin) than in the higher, eastern Mojave Desert. I should place the optimum temperature at about 80 degrees F. The best time for collecting is immediately after darkness has fallen in the earlier spring, but later in the evening in June or early July. Activity declines sharply in mid-summer, although it may be considerable just before dawn; we have not made really adequate tests in these hours.

Cowles (1941, p. 132) expresses the opinion that *eburnata* is one of the most cold-tolerant snakes in southern California; if continuous hibernation exists, it is probably of short duration, possibly only from the middle of December through January. Cowles and Bogert (1944, p. 285) found that *eburnata*

would issue from the ground, but for short periods only, at temperatures as low as 59 degrees F. They concluded that 66–68 degrees probably constitutes the normal lower limit for voluntary surface activity. These figures refer to body, not air, temperatures. The critical temperature was found by these authors to be from 106 to 109 degrees F., and the putative lethal temperature 109 to 111 degrees. Recently-born young suffered at temperatures from 5 to 9 degrees F. lower.

In order to determine the importance of *eburnata* as a component of the total snake population in at least one area (the Borego), I have tabulated all specimens recorded alive or dead, and whether during day or night traveling, along the road between Scissors Crossing (San Felipe Valley) via Sentenac Canyon, Yaqui Well, and The Narrows, to Bensons Dry Lake, in eastern San Diego County. This includes a section of the desert foothills and the desert itself; it involves a desert valley (San Felipe), a rocky gorge with some permanent water (thus accounting for the garter snakes), a wide, sandy, dry wash, and a stretch of desert with scattered brush, cactus, and sand. The total length of this sample strip is 21 miles. The snakes which have been recorded are listed in Table 1.

TABLE 1.

Snakes Encountered on the Road from Scissors Crossing to Bensons Dry Lake

Subspecies	*Number of Specimens*	*Per Cent*
Phyllorhynchus decurtatus perkinsi	271	32.8
Chionactis occipitalis annulatus	181	21.9
Arizona elegans eburnata	70	8.5
*Leptotyphlops humilis cahuilae**	55	6.7
Crotalus cerastes laterorepens	49	5.9
Rhinocheilus lecontei clarus†	43	5.2
Masticophis flagellum piceus	39	4.7
Hypsiglena ochrorhyncha ochrorhyncha	29	3.5
Lichanura roseofusca roseofusca	29	3.5
Lampropeltis getulus californiae‡	16	1.9
Crotalus ruber	16	1.9
Trimorphodon vandenburghi	13	1.6
Thamnophis hammondii	5	.6
Tantilla eiseni transmontana	3	.4
Crotalus mitchellii pyrrhus	2	.2
Salvadora hexalepis hexalepis	2	.2
Pituophis catenifer annectens	2	.2
Pituophis catenifer affinis	2	.2
	827	99.9

* Including *humilis-cahuilae* intergrades.
† Including *lecontei-clarus* intergrades.
‡ Ringed phase.

We find here a greater variety of species than exists in the Mojave-Adelanto-Kramer area (see p. 371), since that portion of the western Mojave contains no rocky section corresponding to the Sentenac Canyon or The Narrows, which account for the presence of such forms as *Leptotyphlops*, *Hypsiglena*, *Lichanura*, *Trimorphodon*, and *Tantilla*. Other differences evident between the two tables, is the high prevalence of the two little snakes *Phyllorhynchus* and *Chionactis* in the Colorado Desert, as compared to their relative rarity in the western Mojave; and the virtual absence of the usually common gopher snakes (*Pituophis*) in the Borego area. As a matter of fact, *P. c. annectens* is quite common somewhat farther west, and *P. c. affinis* is equally prevalent in the Imperial Valley to the east. This intermediate area is evidently not favored by either subspecies.

As to *eburnata* itself, it is seen to be the most common of the larger snakes in the Borego area, being exceeded in numbers only by the two little ground snakes, the leaf-nose and the shovel-nose.

Eburnata feeds principally on lizards and small mammals, remains of both having been found in a number of specimens. One rather small individual contained a full-grown *Uta stansburiana hesperis*. J. R. Slevin found a specimen near Yuma which contained a *Dipsosaurus*. I have one in my collection which had eaten a leaf-nosed snake. C. B. Perkins, at the San Diego Zoo, found that captive specimens preferred lizards, especially *Coleonyx*, to mice, of which they seemed to be afraid. Mosauer (1935, p. 20) fed captive specimens on *Uma* and *Callisaurus*.

Eburnata is usually a peaceful snake, although rarely one will bite when first picked up. It is generally slow-moving and specimens found on the desert roads at night seldom escape. But I have one field note to the effect that a large specimen on the road at Bensons Dry Lake at 7 o'clock in the evening, with the air temperature 91 degrees F., was very lively and quite hard to catch. One individual at Little Morongo Canyon was seen to raise its head and look about in the manner so characteristic of the racers.

Specimens have been found containing 4, 5, 6, 7, and 9 eggs. The smallest of these mothers measured 750 mm. We have not yet been successful in hatching this species at the San Diego Zoo. Cowles and Bogert (1944, p. 285) report a female which laid 23 eggs; these hatched in 68 days.

Range.—The desert areas of extreme southwestern Utah, southern Nevada, the eastern and southeastern desert areas of California south of central Inyo County (but excluding the extreme western Mojave Desert), northeastern Baja California, Mexico, southwestern Yuma County, Arizona, and northwestern Sonora, Mexico.

Locality Records.—

Utah

Washington County:
1 mi. e. of St. George
Watercress Spring
Near Bloomington

NEVADA

NYE COUNTY:
- 9½ mi. s. of Oak Spring (alt. 4400 ft.)

CLARK COUNTY:
- Kaolin
- Near mouth of Virgin River
- 2 mi. s. of Ripley
- Garnet
- Indian Springs Ranch (42 mi. nw. of Las Vegas)
- Boulder City (also just outside at alt. 2000 ft.)
- Boulder City to Las Vegas road (at alt. 2400 ft.)
- Bracken
- Erie
- Jean

CALIFORNIA

SAN BERNARDINO COUNTY:
- 2 mi. n. of Topock
- Sacramento Mountains
- Goffs
- 6 mi. n. of Vidal
- Yucca Station
- 5 mi. e. of Baker
- 7 mi. w. of Ludlow
- 34 mi. e. of Barstow
- Daggett
- Nebo
- Barstow* (also 1 mi. n.)
- Mace
- Lenwood
- Hodge (also 3 mi. sw.)
- Wild
- Helendale
- Bryman
- Deadmans Point
- 5 and 13 mi. e., and 13 mi. ne. of Victorville
- 3 mi. n. of Box S Spring
- Twentynine Palms (also 14 and 18 mi. w.)
- West end of Morongo Valley

RIVERSIDE COUNTY:
- Blythe (also 4 mi. s., and 7 and 16 mi. w.)
- West end Granite Mountains (18 mi. w. of Freda, San Bernadino County)
- 2 mi. e. of Hopkins Well
- Desert Center
- Hayfield
- 5 mi. e. of Shavers Summit
- 7 mi. n. of Twentynine Palms Junction
- Cabazon† (also 3 and 5 mi. e.†)
- Indio (also 1 and 9 mi. s. and 7 mi. nw.)
- 3 mi. up Little Morongo Canyon
- 5 mi. nw. of Wide Canyon Junction
- Ferguson Ranch (Coachella Valley)
- Coachella (also 1 mi. n. and 4 and 8 mi. s.)
- Thermal (also 3 mi. w.)
- Mecca (also 1 mi. w.)
- Box Canyon (near Mecca)
- Salton
- North shore Salton Sea
- Oasis (also 2 mi. se. and 14 mi. n.)
- Date Gardens
- US 99 at Imperial County Line
- Whitewater
- Palm Springs RR. Station
- Garnet (also 4 mi. n.)
- Edom
- Dry Camp
- Myoma
- Palm Springs (also 4, 5, 10 and 13 mi. n., and 2, 5, 6, and 7 mi. nw.)
- Cathedral City (also 3 mi. s. and 3 mi. se.)
- Junction US 99 with Palms to Pines Highway
- Indian Wells (also 5 mi. w.)

SAN DIEGO COUNTY:
- Collins Valley
- Clark Dry Lake
- Beattys Ranch (Borego Valley) (also 3 mi. e.)
- Borego Springs (also 2 mi. s.)
- Borego Palm Canyon
- Borego (abandoned townsite, also called San Felipe, near Halfhill Dry Lake)
- Sentenac Canyon (also 2 mi. e. and 1 mi. w. of the bridge)

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* Some of the succeeding localities in the San Bernardino County list may represent *candida-eburnata* intergrades; these localities are along the Mojave River, between Barstow and Victorville, from the Apple and Lucerne valleys, and near Twentynine Palms.

† *Occidentalis-eburnata* intergrades.

SAN DIEGO COUNTY (Continued):
- Yaqui Well (also 2 and 4 mi. w., and 3 mi. e.)
- The Narrows (also 1, 2, 3, 4, 5, mi. e., and 1, 2, 3, 4½, and 5 mi. w.)
- Bensons Dry Lake (type locality) (also 2, 3, 4, and 6 mi. w., and 2 mi. e.)
- San Felipe Wash (1 and 6 mi. w. of Imperial County Line)
- La Puerta (=Mason Valley)
- Vallecito
- Carrizo Spring
- Banner* (also 2 and 3 mi. e.*)
- Scissors Crossing* (also 1, 2, and 3 mi. e.*)
- Cigarette Hill* (San Felipe Valley)
- Top of Sentenac Canyon*
- Las Arenas Ranch * (San Felipe Valley)
- Near Mountain Spring*
- Jacumba*

IMPERIAL COUNTY:
- Boulder Park*
- Mountain Spring*
- Coyote Wells
- Plaster City (also 3 mi. e.)
- Dixieland
- Seeley (also 5 mi. s.)
- Travertine Rock
- Seaview (also 3 mi. s.)
- 12 mi. e. of Bensons Dry Lake (San Diego County)
- Kane Spring
- 6 mi. n. of Mt. Signal P. O.
- Holtville (also 2 mi. e.)
- Date City
- East edge of sand hills on US 80 (about 13 mi. w. of Winterhaven)
- Winterhaven (also 2, 3, and 11 mi. w.)

ARIZONA

YUMA COUNTY:
- Yuma (also 9 mi. e.)
- 2 mi. n. of Somerton
- Dublin (also 2 mi. w.)
- 17 mi. w. of Wellton
- Tacna† (also 4 mi. e.)
- Pembroke†
- 50 mi. e. of Yuma† (= 2 mi. e. of Colfred)
- Mohawk† (also 2 mi. e.†)
- Kim†
- Stoval†
- 1 mi. w. of Aztec†

SONORA, MEXICO

Punta Peñasco.

Arizona elegans candida subsp. nov.

WESTERN-MOJAVE GLOSSY SNAKE

Plate 8, fig. 2.

1930. *Arizona elegans occidentalis* (part) Bogert, Bull. Sou. Cal. Acad. Sci., vol. 29, part 1, p. 5.

Type.—No. 34191 in the collection of LMK. Collected at Kramer Hills (6 miles south of Kramer Junction on US 395), San Bernardino County, California, by James Deuel, June 16, 1941.

Diagnosis.—*Candida* is a subspecies characterized by its light color, narrow dorsal blotches, and the high frequency of paired preoculars. It differs from all subspecies except *eburnata* in having dorsal blotches which are uniformly shorter (along the body) than the interspaces which separate them. From *eburnata* it differs in its high proportion of paired preoculars, and somewhat wider and fewer dorsal blotches, which usually engage 7 scale rows in

* *Occidentalis-eburnata* intergrades.
† *Eburnata-noctivaga* intergrades.

eburnata and 9 in *candida*. Also, the latter has fewer ventral scutes on the average, although there is considerable overlapping.

Description of the Type.—The type specimen is an adult male; length over-all 823 mm.; tail length 112 mm.; tail proportion 13.6 per cent. These measurements were made before the specimen had set in preservative.

The head is slightly convex on top; it is little wider than the neck. The snout is moderately pointed and the lower jaw inset. The pupil is almost round.

The scales of the head are normal. The rostral is sharply recurved and somewhat wider than high. It contacts the first supralabials, the anterior nasals (rather narrowly), and the posterior point separates the internasals for about half their lengths. The internasals are longer than wide and curve down in front to the nasals. The prefrontals are quadrangular in shape, with their post-lateral points curved well down over the canthus rostralis. They are indented by the upper points of the postnasals. The frontal is pentagonal, narrowing along the supraoculars and then more sharply between the parietals. The supraoculars are narrowly in contact with the prefrontals; they widen posteriorly. The parietals are large and touch somewhat over half the posterior edges of the upper postoculars. Posteriorly they are rather pointed. The postnasal is considerably larger than the anterior; the nostril is at the upper end of the separating suture, which is not complete above the orifice. Of the supralabials, the postnasal touches only the first. There is a single quadrangular loreal on either side about twice as long as high, touching the first to third supralabials. The posterior edge of the loreal is substantially vertical on the right and almost so on the left. There are two preoculars; the upper is both higher and wider. The postoculars are 2–2. The temporals are 2+3, 2+5. The supralabials are 8–8, the fourth and fifth touching the eye, and the seventh much the largest. The mental is small and subtriangular. The infralabials are 13–13, the first in contact behind the mental, and the seventh much the largest. There are two pairs of genials, the anterior considerably the longer, and medianly in contact; the posterior are slightly divergent and are separated by three rows of gulars.

The dorsal scale rows are 27–27–19. The scales are smooth, rather narrow and with rounded ends. The middorsal and lateral rows are the widest. There are single apical scale pits; however, these are quite small and faint. The ventral scales number 214; the anal plate is entire; the subcaudals 50, all divided.

The head is buff above and lighter on the sides. There is a dark-brown bar across the posterior edge of the prefrontals; also posteriorly on the frontal, and along the parietal suture. There is faint evidence of a vertical dark mark below the eye, and an obsolescent dark streak from the eyes back to the angle of the jaw. The lower surface of the head is immaculate cream-colored.

The body pattern comprises a series of 61 rather irregular brown blotches on a buff background. The irregularity is due to the non-matching of the two sides; sometimes the blotches are diagonal, at others the lack of synchronization is such that there are separate rows on the two sides. These blotches are much wider than long. At mid-body they are about 1 scale long, and 9 scale rows wide. The interspaces are about 2¼ scales (end to end) long. The blotches are dark-edged. The ground color is clearly evident only on the three middorsal

scale rows. Laterally the dorsum is suffused with brown, but the two lowest lateral rows are clear. In addition to the main blotches there are two auxiliary series of brown spots on each side. These are quite indefinite and do not match perfectly with the main series. The lower and smaller comprises merely a series of scattered black spots. The lowest touch the third scale row above the ventrals. The ventrum is immaculate cream-color. There are about 18 indefinite spots on the tail; these are evident on the sides, rather than dorsally.

Summary of Paratypes.—As this subspecies varies slightly in the different parts of its range, I shall summarize the specimens which are considered paratypes, these being from along highway US 395 south from Kramer Junction to Adelanto and a little beyond, all within a few miles of the type locality, Kramer Hills, and all in San Bernardino County, California.* There are in this series (including the type) 40 males and 13 females, together with one extra head.

The statistics of scutellation are as follows: The scale rows are nearly always 27 at mid-body, although there is one specimen with 26 and another with 29. The ventral scutes in the males range from 209 to 220, interquartile range 212.4 to 216.0, mean 214.20∓.42, coefficient of variation 1.24 per cent; the corresponding figures in the females are, over-all range 220 to 232 (including one aberrant individual 8 scutes higher than any other), interquartile range 220.6 to 224.8, mean 222.69∓.86, coefficient of variation 1.40 per cent. The subcaudals in the males range form 47 to 55, interquartile range 49.6 to 52.1, mean 50.83∓.29, coefficient of variation 3.56 per cent; females, range 44 to 49, interquartile range 45.2 to 47.1, mean 46.15∓.39, coefficient of variation 3.09 per cent. The supralabials are normally 8 but are occasionally 9 (6 out of 107 counts). The infralabials vary from 11 to 14, the distribution being 11(4), 12(43), 13(54), 14(6). The loreals are single in all but one count out of 107, this one being split. In 41 counts the preoculars are single; in 67 they are paired. Thus, in this character, which is typical of *candida*, 62 per cent are positive. The postoculars are 2 in 107 counts, and 3 in one. The temporals are usually 2+3, but may vary from 1+2 to 2+5 or 3+4.

The body blotches range from 55 to 73, interquartile range 59.9 to 65.1, mean 62.50∓.53, coefficient of variation 6.23 per cent; and the tail spots over-all range 14 to 24, interquartile range 17.1 to 20.3, mean 18.72∓.33, coefficient of variation 12.8 per cent. The body blotches usually cover 9 scale rows across the trunk, but occasionally occupy 10, or rarely, 8. The longitudinal extent of

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*The paratypes are as follows (A=Adelanto, KJ=Kramer Juntion, KH=Kramer Hills; the figures are miles; all specimens are LMK unless otherwise stated): 27251 16 n. A, 28846 KH, 28848 8 n. A, 31700 KH, 31766 5 n. KJ, 31917 12 s. A, 31940 8 s. KJ, 31941 3 n. A, 31942 3 n. A, 31959 20 s. KJ, 33323 6 sw. A, 33795 KH, 33812 6 n. A, 33826 3 s. KJ, 33832 8 s. KJ, 33888 5 s. KJ, 33975 7 s. KJ, 33977-8 10 s. KJ, 33979 12 s. KJ, 33980 8 n. A, 33981 4 s. A, 33982 14 n. A, 33983 8 s. KJ, 34017 7 s. KJ, 34019 8 s. KJ, 34164 5 s. KJ, 34165 6 s. KJ, 34184 1 w. KJ, 34185 1 e. KJ, 34186 11 s. KJ, 34187 16 n. A, 34189 3 s. KJ, 34190 16 n. A, 34192 5 s. KJ, 35093 4 s. A, 35107 13 n. A, 35109 3 n. A, 35149 KH, 35150 A, 35151 KJ, 35536 7 s. KJ, 35537 9 s. KJ, 35594 2 n. A, 35654 6½ s. KJ, AMNH 60570 6 w. A, MCZ 44846-7 A, MVZ 39604 7 sw. A, MVZ 39605 3 s. A, MVZ 39606 5 s. A, MVZ 39607 7 sw. A, MVZ 39643 5 s. A.

the blotches is 1 to 1½ scales, while the interspaces measure 1½ to 2½ scales (end to end). In only one specimen of the paratype series do the body blotches equal the interspaces in longitudinal extent. The brownish side-suffusions usually reach down to the second or third lateral rows above the ventrals, and the lateral spots generally touch the same rows. This subspecies is the lightest and has the smallest spots of any except *eburnata*.

The tail ratio is from 12.8 to 14.7 per cent in the males, and 11.6 to 13.1 in the females. The adult males average about 14.0 and the females 12.5 per cent.

Material.—In addition to the type and paratypes (40 males and 13 females, all from San Bernardino County) the following specimens, all from California, are available: San Bernardino County 2, Los Angeles County 13 (several may be considered *occidentalis-candida* intergrades), Kern County 14, Inyo County 3; grand total 85. There are 65 males and 19 females, the other being a head only.

Description of Subspecies.—This is a snake of average colubrid proportions, neither particularly stout nor slim. The head is slightly distinct from the neck; viewed from above it is wedge-shaped but with a rounded snout. From the side the top of the head is convex; the snout is advanced and the jaw deeply inset. The snout is moderately sharp; the forward part slants upward, so that the tip is toward the upper end of the rostral. The eyes are rather protuberant; the diameter of the orbit is equal to about 80 per cent of the distance from the anterior edge of the orbit to the nostril. The pupil appears almost round in most preserved specimens but is slightly elliptical in life.

The longest specimen I have seen, a male from 5 miles east of Lancaster, Los Angeles County, measured 870 mm. The smallest specimen measured 245 mm. The tail proportion (ratio to length over-all) varies from 12.6 to 15.3 per cent in the males, and in the females from 11.6 to 13.3 per cent. The averages are 13.9 per cent in the males and 12.5 in the females. The young specimens have proportionately shorter tails than the adults to a small degree (*cf.* p. 354).

The body is covered with smooth scales. The middorsal and lower lateral rows are slightly enlarged. There are single apical scale pits, but they are not evident on all scales, and in any case are quite inconspicuous.

The scale rows at mid-body are usually 27, but 3 specimens out of 84 have 29, and one has 26. The ventrals in the males vary from 208 to 220, the interquartile range is 212.3 to 216.1, the mean 214.22∓.35, and the coefficient of variation 1.32 per cent. The over-all range in the females is from 220 to 232, the interquartile range 221.2 to 225.6, the mean 223.37∓.75, and the coefficient of variation 1.46 per cent. The anal is entire. The subcaudals, all divided, vary from 47 to 55 in the males, the interquartile range being 49.7 to 52.1, the mean 50.92∓.22, and the coefficient of variation 3.47 per cent. In the females the over-all range is 44 to 49, the interquartile range 45.4 to 47.2, the mean 46.25∓.30, and the coefficient of variation 2.88 per cent. The coefficient of

sexual divergence in the subcaudals is 9.6 per cent. The terminal scale is somewhat elongated, and has a lateral crease.

The head scales follow the usual colubrid pattern. The rostral is rather sharply curved, both over the top of the snout and below, and is longitudinally concave on the underside. It is wider than high. The upper point separates the internasals for approximately half their lengths; it also contacts the prenasals and the first supralabials. The internasals are longer than wide, and curve downward to a point between the prenasals and rostral. The prefrontals are wider than high and curve down over the canthus rostralis to a broad contact with the loreals. Rarely the prefrontals are fused into a single plate. The supraoculars are widest posteriorly; they contact the prefrontals rather narrowly. The frontal is widest anteriorly; it does not deeply indent the suture between the parietals. The parietals are the largest of the head scales. They are rather regular in shape, narrowing posteriorly. The dorsal scales which border them are somewhat enlarged, but are irregular. The prenasal is much smaller than the postnasal. The nostril is at the upper end of the diagonal suture which divides the nasals; it slopes forward above. The suture is usually not complete above the nostril. While the postnasal most often contacts the first and second supralabials, in some specimens it touches only the first. The loreal is twice as long as wide, and is highest forward; posteriorly where it contacts the preocular the end is almost vertical, especially in those specimens which have 2 preoculars. In the others the end may be somewhat pointed, as in the other subspecies. The loreal contacts the second and third supralabials. One specimen out of 86 has a divided loreal on one side. The preoculars are usually paired in this subspecies (its outstanding characteristic), 108 out of 172 counts, or 62.8 per cent having 2. When there are 2 preoculars, the upper is the larger. The postoculars ordinarily number 2, and are subequal in size; there are 3 in two counts out of 172. The temporals are usually 2+3 or 2+4, but vary from 1+2 to 2+5 and 3+4. Those in the first series are usually long and thin, and slope upward posteriorly. The supralabials are usually 8, but occasionally number 9 (7 per cent), or even 10 (0.6 per cent). The fourth and fifth touch the eye; the next to the last is always much the largest. The infralabials vary from 11 to 15, the distribution being 11(6), 12(58), 13(96), 14(9), 15(1). The first pair meet on the median line. Usually the seventh is the largest of the series, but not infrequently the largest is the sixth. The mental is small and triangular, with concave sides. The anterior genials are large and contact on the median line; the posterior are both slimmer and shorter, and, diverging posteriorly, are separated by from 2 to 4 rows of gulars.

Candida is a blotched snake, with brown transverse blotches on a cream-colored background. In some specimens the blotches are somewhat obscured by a lateral brownish suffusion.

The head is buff or light-brown above, with somewhat lighter sides, especially at the supralabials. There is a brown cross-band on the posterior edges of the prefrontals, a pair of spots at the rear end of the frontal, a mark on each supraocular, where it contacts the postocular, and several spots, or a brown line, on the suture between the parietals. There is a brown streak or bar from the

orbit to the angle of the mouth; also a dark spot or vertical line below the eye. There may be a few spots in the loreal-nasal region. The lower jaw is immaculate.

On the neck there is usually a pair of parallel blotches edged with darker, and separated by a light streak. These are the precursors of the dorsal series.

The dorsal blotches occupy considerably less longitudinal space than the interspaces which separate them. The body blotches vary in number from 55 to 73, interquartile range 60.3 to 65.6, mean 62.91∓.43, coefficient of variation 6 24 per cent. The tail spots have an over-all range of 14 to 24, interquartile rang 17.0 to 20.2, mean 18.61∓.26, coefficient of variation 12.6 per cent. The body blotches at mid-body cover from 8 to 11 scale rows across the body, but in most specimens they span 9 rows. The longitudinal extent of the blotches, again measured at mid-body, varies from 1 to 2 scales, end to end, but most specimens cover only 1 to 1½ scales. The interspaces are wider; most of them are 2 scales in length, but the range is from 1½ to 3 scales. The lateral brown suffusion is usually carried down to the second or third row above the ventrals. The lateral spots of the auxiliary series sometimes touch the scale row next to the ventrals, but more often do not extend below the second or third row.

The body blotches are elongated transversely, and are often quite irregular because the patterns of the two sides do not exactly keep step. This results in many diagonal blotches, and other half-blotches which are restricted to one side.

In addition to the main dorsal blotches, there are, on each side, several alternating series of progressively smaller spots. The first series is sometimes moderately regular and clearly evident; but those below are virtually only irregular darkened scale edges.

The main dorsal blotches are composed of brown punctations, with dark-brown or black edges. These edges are often irregular and imperfect. Between blotches the ground color is cream, but if this is evident at all dorsally it is only on the 3 middorsal scale rows, for laterally the area between blotches is heavily suffused or stippled with brown. This darkening occurs particularly in scale centers; the scale edges are usually light, giving a characteristic net-work effect. The lateral darkening tends to obscure the outer edges of the middorsal blotches and the lateral series as well. With respect to the side suffusion there is a considerable variation between specimens, for in some it is relatively light, whereas in others it is quite dark. In some individuals the middorsal rows are clear, while in the others the suffusion crosses the dorsum. Where the central light streak is evident, it is accentuated posteriorly; on the tail it often splits the central spots into two parallel series. This is the case in all the western subspecies, but is more prevalent in *candida*.

Young specimens usually lack the interblotch suffusion, the dorsal and lateral spots, and the head marks also, being clearer than in the adults.

Intrasubspecific Trends.—*Candida* is so territorially concentrated that no important character trends are evident from the material thus far available.

Relationships with Other Subspecies—*Candida* inhabits the Antelope Valley, and the Mojave Desert west of the Mojave River and the approximate line Barstow-Randsburg; it is also found in Inyo County, at the foot of the Sierras

as far north as Lone Pine. Intergradation with *eburnata* occurs along the eastern border of this area, but just where is as yet undetermined. The specimens of Apple and Lucerne valleys are evidently *eburnata*, yet two specimens from the Morongo Valley and west of Twentynine Palms have the paired preoculars typical of *candida*. For the present I have considered them intergrades.

Intergradation between *candida* and *occidentalis* occurs along the desert slope of the San Gabriel Mountains in Los Angeles County, at such points as Humphrey, Vincent, and Valyermo. Presumably intergrades will also be found on the southeasterly slope of the Tehachapis in Kern County, but I have no specimens from that region.

Life History Notes.—*Candida* is a resident of the high, wind-swept, western Mojave Desert, an area of sparse brush, Joshua trees at the higher levels, and loose sandy soil. Much of it has an altitude of about 2600 ft. (Mojave 2733, Palmdale 2669, Adelanto 2877, Kramer 2490). Most specimens were collected at night when the character of the surrounding country could not be ascertained, but the classification would usually be light brushy desert. The following additional surroundings have been observed: Heavy brush, medium brush, Joshua trees, and sandy desert. It reaches an altitude somewhat in excess of 4000 ft. (1 mi. east of the summit of Walker Pass).

Times of collection have been noted as follows:

7:00 to 7:29 p. m.	2
7:30 to 7:59	4
8:00 to 8:29	6
8:30 to 8:59	12
9:00 to 9:29	6
9:30 to 9:59	4
10:00 to 10:29	3
10:30 to 10:59	4
11:00 to 11:29	1
3.30 to 3:59 a. m.	2
Total	44

Of course, these collecting records reflect not only the times of activity of the snakes, but the collectors as well. It is my judgment that in the spring, when the desert cools quickly after sunset, the snakes seek refuge early; in summer they may be active all night, and then, in fact, the temperatures may be most suitable just before dawn. But on the cold and windy spring nights, one may readily infer from the presence of live snakes early in the evening, and DOR's later, that the time of maximum activity is soon passed. At any rate, the nocturnal character of this desert snake is not to be doubted, for I have yet to find a specimen abroad in the daytime. Of the 44 snakes whose time of collection was recorded, the earliest was 7:15 p. m. (May 10, 1941, about one-half hour after sunset).

The maximum seasonal activity I should place at about June 10, somewhat later than that of *eburnata* in the Colorado Desert, which, at a lower altitude, warms earlier.

The air temperatures when *candida* was collected were as follows:

56-57 deg. F.	1
58	0
60	3
62	1
64	3
66	0
68	3
70	4
72	7
74	2
76	3
78	5
80	4
82	1
84	0
86	0
88	0
90-1	1
Total	38

No doubt this table unfairly represents the higher temperatures, for I have done almost no collecting in the Mojave in the summer. At any rate, this does indicate the surprisingly low temperatures at which snakes may remain active. I remember picking one up at 10:45 on a cold and, as usual on the Mojave, windy spring night; the air temperature was 60° F., and the snake was so stiff and dull it was presumed to be a traffic casualty, but the next morning it was quite well and lively.

In the section of the desert which it inhabits, *candida* is the second commonest snake, as is shown by the following table of specimens recorded by myself and associates in the Mojave-Palmdale-Adelanto-Kramer area. This table includes both live and DOR specimens, and both day and night collecting, thus giving a representation to both diurnal and nocturnal forms.

	Number of Specimens	*Per Cent*
Crotalus cerastes cerastes	131	21.7
Arizona elegans candida	95	15.7
*Rhinocheilus lecontei lecontei**	89	14.7
Pituophis catenifer deserticola	79	13.1
Crotalus scutulatus scutulatus	78	12.9
Masticophis flagellum piceus	60	9.9
Chionactis occipitalis occipitalis	39	6.4
Lampropeltis getulus californae†	20	3.3
Phyllorhynchus decurtatus perkinsi	8	1.3
Salvadora hexalepis hexalepis	6	1.0
	605	100.0

* Includes some *R. l. clarus.*

† Ringed phase.

Although it is believed that *candida* prefers lizards, several specimens containing mice (one a pocket mouse), or mammal hair, have been noted.

One specimen 856 mm. long contained 10 eggs; another 661 mm. in length, 4 eggs.

Although *Arizona* rarely endeavors to bite, a specimen which had been injured did so.

Range.—The Antelope Valley and extreme western Mojave Desert, including the desert areas of southwestern Inyo County, southeastern Kern County, northeastern Los Angeles County, and western San Bernardino County, California.

Locality Records.—

CALIFORNIA

INYO COUNTY:
- 10 mi. s. of Lone Pine
- Brier
- Haiwee
- Coso Junction
- Little Lake
- Emigrant Checking Station* (Death Valley National Monument)

KERN COUNTY:
- Brown
- 3 mi. ssw. of Inyokern
- 1 mi. e. of Summit of Walker Pass
- Searles Station
- Randsburg (also 5 mi. w.)
- 3, 5, 9, and 14 mi. w. of Amargo
- Boron (also 6 mi. w.)
- Mojave (also 2 mi. n., and 3, 5, 6, 7, and 8 mi. e.)
- 5 mi. n. of Muroc

LOS ANGELES COUNTY:
- Neenach (also 3 mi. w.)
- Between Neenach and Fairmont
- Lancaster (also 5 and 15 mi. e.)
- Denis
- Palmdale
- Vincent†
- Humphrey†
- Littlerock†
- Fort Tejon Road† (between Pallet Creek Road and Griffin Road)
- Valyermo† (also 2 mi. s.)
- Pecks Butte (= Piute Butte)
- Lovejoy Springs
- Llano (also 10 mi. e.)

SAN BERNARDINO COUNTY:
- 4 mi. n. of Red Mountain
- Kramer
- Kramer Junction (also 3 and 5 mi. n., 1 mi. e., 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, and 20 mi. s., and 1 mi. w.)
- Kramer Hills (type locality) (also 8 mi. s.)
- Jimgrey
- Adelanto (also 2, 3, 6, 8, 13, 14, and 16 mi. n., 2, 3, 4, 5, and 12 mi. s., 5, 6, and 7 mi. sw., and 6 mi. w.)
- 5 mi. sw. of Victorville
- 4 mi. s. of Hesperia
- Phelan (also 5 and 6 mi. n.)

Arizona elegans occidentalis Blanchard

CALIFORNIA GLOSSY SNAKE

Plate 7, fig. 2.

1894 *Coluber arizonae* (part) Boulenger, Cat. Snakes Brit. Mus., vol. 2, p. 66. (See remarks under *elegans*, p. 321.)

1897 *Arizona elegans* (part) Van Denburgh, Occ. Papers Cal. Acad. Sci., no. 5, p. 193.

1900 *Rhinechis elegans* (part) Cope, Rept. U. S. Nat. Mus. for 1898, p. 863.

* Specimen not available; may be *eburnata* or an intergrade.

† *Occidentalis* intergrade.

1924 *Arizona elegans occidentalis* (part) Blanchard, Occ. Papers Mus. Zoöl. Univ. Mich., no. 150, p. 1. Type specimen USNM 54372; type locality La Jolla, San Diego County, California.

Diagnosis.—*Occidentalis* is a subspecies inhabiting a territory having a considerable ecological variability and therefore it is subject in itself to considerable variation. It is characterized by a darker color than the other western subspecies. It may be distinguished from *elegans* and *blanchardi* by its usually having 27 scale rows compared with 29 or 31 in the eastern forms. Also, its blotches average higher in number and are narrower across the body. *Occidentalis* has more ventrals and a proportionately shorter tail than *philipi* or *expolita*, and more blotches than *pacata*. It is darker in color and with lower spots and brownish suffusions on the sides than *eburnata* or *candida*. Although territorially separated from *noctivaga* by *eburnata* and *candida*, it is most like the Arizona form. However, *noctivaga* has fewer ventrals on the average, is usually lighter on the sides, and the lower lateral scale rows are freer of spots, as is also true of the infralabials.

Material.—The description of the subspecies *occidentalis*, as newly restricted, is based on the following material: Baja California 11; California, San Diego County 38, Riverside County 7, Los Angeles County 3, San Bernardino County 5. These are all from the coastal areas of these counties. In addition there are the following from the San Joaquin Valley section: Kern County 17, Fresno County 8, San Benito County 1, San Joaquin County 2; grand total 92. There are 49 males and 40 females, the rest being indeterminate.

Description of the Subspecies.—This is a snake of normal colubrid proportions, neither heavy-bodied nor attenuated. The head is only slightly distinct from the neck. Viewed from above the head is wedge-shaped but with a rounded or somewhat blunt snout. From the side the top of the head is convex; the jaw is deeply inset. The apex is slightly pointed; the forward part of the snout slants upward, so that the tip is toward the upper end of the rostral. The rostral is sometimes slightly raised above the adjacent scales. The eyes are moderately protuberant; the diameter of the orbit is about equal to ¾ of the distance from the anterior edge of the orbit to the nostril. The pupil is slightly elliptical.

The longest specimen, a female from La Jolla, San Diego County, measured 1132 mm. over-all. The smallest specimen is 248 mm. in length. The tail proportion (ratio to length over-all) varies from 12.6 to 14.7 per cent in the males, and from 11.4 to 13.7 per cent in the females. The mean ratios are 13.6 and 12.5 per cent in the males and females, respectively. The young specimens have somewhat shorter tails proportionately than the adults.

The body is covered with smooth scales, rather narrow and with slightly rounded ends. The lower lateral rows are increasingly wider. Single apical scale pits are present, but they are small and inconspicuous.

The scale rows at mid-body are usually 27 but there are 29 in 20 per cent of the specimens examined. The ventrals in the males vary from 207 to 223, the interquartile range is 211.8 to 216.7, the mean 214.24∓54, and the coefficient of variation 1.72 per cent. The over-all range in the females is from 215 to 231,

the interquartile range 220.2 to 225.8, the mean 223.00∓.67, and the coefficient of variation 1.86 per cent. The anal is entire. The subcaudals, all divided, vary from 47 to 54 in the males, the interquartile range being 49.1 to 51.4, the mean 50.26∓.25, and the coefficient of variation 3.30 per cent. In the females the over-all range is 43 to 50, the interquartile range 45.2 to 47.8, the mean 46.49∓.35, and the coefficient of variation 4.27 per cent. The coefficient of sexual divergence in the subcaudals is 7.8 per cent. The terminal scale is slightly elongated and creased; it is not sharply pointed in the adults.

The head scales follow the colubrid normal in size and arrangement. The rostral is sharply curved, both over the top of the snout and below. It is 20 per cent wider than high. The upper point of the rostral separates the internasals for less than half their lengths; in addition it contacts the prenasals and the first supralabials. The internasals are longer than wide and curve downward to a point in front of the prenasals. The prefrontals are wider than high and curve well down over the canthus rostralis to a level with the center of the orbit, making a broad contact with the loreal. The supraoculars make a narrow contact with the prefrontals; they widen posteriorly, where they contact the parietals and upper postoculars. The frontal is widest anteriorly; it terminates posteriorly at a point which indents the suture between the parietals for about ¼ of their lengths. The parietals are the largest of the head scales. They are moderately regular in shape, narrowing posteriorly. The dorsal scales which border them are somewhat enlarged, as compared to the succeeding dorsals. The prenasal is smaller than the postnasal. The dividing suture slants forward above; the nostril is at the upper end. The suture curves sharply above the nostril and usually terminates in such a way that the nasals remain connected by a narrow isthmus. The postnasal contacts the first and second supralabials. The loreal is more than twice as long as wide, and is highest forward, becoming pointed posteriorly where it contacts the preocular. The loreal borders the second and third supralabials. Divided loreals are present in only 2 out of 180 counts in this subspecies. The preoculars are usually single, although paired in 6 counts out of 180; they are wider above than below, where they are indented by the loreals. The postoculars ordinarily number 2, and are about equal in size; there are 3 in 6 counts out of 180. The temporals are usually 2+3 or 2+4, but vary from 1+2 to 2+6 and 3+4. Those in the first series are longer than wide and slant upward posteriorly. The supralabials are usually 8; the dispersion in the available specimens is 6(1), 7(6), 8(157), 9(11), 10(1). When there are 8 the fourth and fifth contact the eye; the next to the last is always the largest of the series. The infralabials vary from 11 to 15, the distribution being 11(3), 12(28), 13(118), 14(24), 15(1), mean 12.95. The first pair meet on the median line. The seventh is much the largest of the series. The mental is small and triangular, with concave sides. The anterior genials are large and contact on the median line; the posterior are both thinner and shorter, and, diverging posteriorly, are separated by from 2 to 5 rows of gulars.

Occidentalis is a brown snake marked by darker-brown blotches down the back, and additional series of smaller blotches on the sides.

The head is medium-brown, although the upper labials are lighter. There is a brown band, slightly darker than the ground color, on the posterior edges of the prefrontals; also, irregular dark-brown spots on the supraoculars, frontal, and parietals. These spots tend toward obsolescence in adults. There is a brown streak from the orbit to the angle of the mouth; also, there is often a brown spot below the eye. There is usually a small brown spot on each first infralabial, and posteriorly the sutures between the infralabials are spotted with brown. These marks on the lower jaw are characteristic of this subspecies and will often aid in segregating it from the desert subspecies *noctivaga, eburnata,* and *candida;* however, they are often absent in specimens from the San Joaquin Valley.

On the neck there is usually a pair of parallel dark marks separated by a light streak. These, the first of the dorsal series, are much longer than those which follow.

The dorsal blotches in this subspecies are about equal to the interspaces which separate them. The body blotches vary in number from 51 to 75, interquartile range 59.3 to 66.1, mean 62.70∓.55, coefficient of variation 8.1 per cent. The tail spots have an over-all range of 13 to 25, an interquartile range of 16.7 to 20.0, with a mean of 18.33∓.29, and a coefficient of variation of 13.3 per cent. The body blotches at mid-body cover from 7 to 13 scale rows across the body, but in most specimens they span 9 to 11 rows. The longitudinal extent of the blotches, again measured at mid-body, varies from 1 to 3 scales, end to end, but most specimens extend from 1½ to 2 scales. The interspaces are sometimes slightly wider, sometimes narrower, than the blotches; most of them are from 1½ to 2 scales in length. The lateral brown suffusion is usually carried as far as the first to third row above the ventrals. The lowest lateral spots of the auxiliary series usually touch the ventrals or the first lateral row, although rarely these spots do not extend below the second or third row. Sometimes there are a few spots well out on the ventrals, which, otherwise, are buff.

The body blotches, although generally elliptical, with the major axis transverse, are often quite irregular because the patterns of the two sides do not exactly match. This results in some diagonal blotches, and others which are restricted to one side, while still others are Y-shaped, double on one side and single on the other.

In addition to the main dorsal blotches, there are, on each side, at least two alternating series of progressively smaller spots. The first of these series comprises vertically elliptical spots, alternating with the dorsal series; it is rather regular and in most specimens as well defined as the main series. The next series below are hardly more than dark scale marks in many individuals.

The main dorsal blotches are brown, with dark-brown or black edges. Between blotches the ground color is buff, but this is evident only on the middorsal scale rows, and in many specimens not even here, so general and dark is the interblotch suffusion, often, in fact, so dark as to leave little contrast between blotches and interspaces. This darkening occurs particularly in scale centers; the scale edges are usually light, giving a net-work effect characteristic of *Arizona,* which is more marked in some territories, the San Joaquin Valley

for example, than others. The interblotch suffusions are accentuated with age; the spots and blotches, both on the head and body, are more clearly evident in the young. The middorsal lightening sometimes affects, not only the ground-color suffusion, but the blotches themselves, particularly toward the tail, where the dorsal series may be split by a central light streak.

A live juvenile specimen from Lakeside, San Diego County, showed the following Ridgway (1912) colors: Dorsal blotches, Seal Brown; dorsal interspaces, Avellaneous to Wood Brown; ventral surface White and somewhat translucent.

Intrasubspecific Trends.—In *occidentalis* the ventral scutes are highest in number in the snakes of coastal San Diego County, declining slightly both to the north and south. The subcaudals, on the other hand, show an increase toward the north, as do the infralabials as well.

The body blotches and tail spots are highest in number in San Diego County, decreasing to the north and south. Also, the blotches are larger both in width and length, in the San Diego snakes, thus showing the greatest divergence from *eburnata.* Both in the San Joaquin Valley, and at the southern end of the range in Baja California (about lat. 30° 30′ N.), the blotches are relatively smaller and more frequently exceed the interspaces in extent. There is less ground-color suffusion on the sides, and the lateral spots are not carried so low as in the San Diego County snakes, nor are the spots on the infralabials as prevalent. Thus, in all these pattern characteristics, warmer and drier conditions have produced, in *occidentalis,* a trend toward the desert form *eburnata.* Or possibly this statement should be revised to suggest a retention of the desert characteristics.

The tail proportionality in *occidentalis* increases slightly from south to north.

Relationships with Other Subspecies.—As I have already pointed out in discussing those subspecies, *occidentalis* intergrades with both *eburnata* and *candida* on the desert slopes of the coastal mountains.

Life History Notes.—The differences in daily activity which are found in *Pituophis,* between the coastal and desert forms, the former being largely diurnal and the latter nocturnal, are not so evident in *Arizona;* for the coastal subspecies *occidentalis* is almost, if not quite, as nocturnal as its desert congeners, *eburnata* and *candida.* This is evident from the rarity of its discovery in the daytime, whereas the frequency of DOR's indicates that it is not uncommon in the territory. I have never found a specimen abroad in the daytime, the earliest being 6:25 p. m. at La Posta. L. M. Huey found one at 9 p. m. at Valle de la Trinidad, Baja California. Linsdale (1932, p. 377) reports a specimen active at 6 a. m., just as the sun was coming up. *Occidentalis* is so much darker than *eburnata* and *candida,* particularly from a lateral view, that it is relatively difficult to see at night. Thus, we have had nothing like the success, in collecting this subspecies, that has attended our desert efforts; however, it must be admitted that slow driving for snakes on the coastal side of the mountains is seldom tried. In the lower San Joaquin Valley, where summer temperatures are high, *occidentalis* is lighter than along the coast, and may be hunted using the desert scheme.

Here I have taken live specimens on the road at 8:00, 8:50(2), 8:55, 9:06, and 10:45 p. m. The air temperature was as low as 60° F. Judging from my own collecting experiences, both day and night, I should say that, with the possible exception of the Bakersfield area, *occidentalis* represents a much smaller part of the total snake population than that represented by *eburnata* and *candida* in some desert areas.

There is some evidence that *Arizona* is not uniformly distributed in the coastal territory of southern California, but occurs in colonies, for DOR's have been found again and again in the same localities—for example, La Costa, Mission Valley, and Warners Ranch—whereas other places having the same characteristics seem uninhabited by this snake. However, in San Diego County, it is known to occur in all ecological zones, from the coast to the mountain foothills; although in the mountains themselves it is absent, or at least very rare. I know of no locality of collection higher than Warner Springs (alt. 3132 ft.). About 60 per cent of the specimens have been from the coastal area, some on the cliffs immediately above the surf. The relative frequency of surroundings where specimens have been found is shown in the following list:

Grass (uncultivated)	22
Field (cultivated)	17
Light brush	7
Chaparral	7
Barren field	4
Orchard	3
Sand	1
Rocks	1
Total	62

This list indicates a definite preference for open areas, for much of the territory hunted in has a dense brush cover.

Seasonally, *Arizona* seems to be a trifle later than the other snakes of the area, for June slightly exceeds May as the peak month, whereas the contrary is true of most of the other species.

Specimens of *Arizona* are occasionally plowed out, showing that they hibernate at a comparatively shallow depth. I have records of specimens being plowed out on Feb. 10, 23, and 24. Paul Breese found one under a foot of sand in a vineyard at Alta Loma, San Bernardino County. L. H. Cook found one under a board; another was disclosed by turning over a rock, while a third was buried in sand. Specimens in captivity bury themselves readily in loose soil or sand.

Lizards seem to be the preferred food of this subspecies, particularly the two common forms *Uta stansburiana hesperis* and *Sceloporus occidentalis biseriatus*, there being several records of both of these forms being found in collected specimens. L. H. Cook placed a newly captured snake in a bag with several lizards. Two utas were taken, one head first, the other tail first. Mammal hair has been found in several specimens. Cook (1930, p. 158), Hanley (1943, p. 145) and Reynolds (1943, p. 196) have reported on food

habits in captivity. Reynolds states that sparrows were eaten (subspecies of snake according to the new classification not given). C. B. Perkins tells me that at the San Diego Zoo lizards are always more readily accepted than mice by captive specimens.

A specimen 731 mm. long from Oilfields, Fresno County, contained 7 eggs. The hemipenial characteristics are similar to those of *eburnata*.

A specimen bitten by a small rattlesnake died the next day.

Range.—The San Joaquin Valley in California, south from central San Joaquin County to the Tehachapi Mountains; and coastal and cismontane southern and Baja California from Los Angeles County south to San Quintín (lat. 30° 30′ N.). Intergrades with *candida* on the desert side of the San Gabriel Mountains, and with *eburnata* on the desert slopes of the San Bernardino, San Jacinto, and Peninsula ranges.

Locality Records.—

CALIFORNIA

SAN JOAQUIN COUNTY:
- Corral Hollow Creek (7 mi. ssw. of Tracy)
- Corral Hollow Creek (3 mi. e. of Tesla)

SAN BENITO COUNTY:
- Panoche Creek (2 mi. se. of Panoche)

FRESNO COUNTY:
- Fresno
- 3 mi. w. of Conejo
- Oilfields
- Coalinga (also 2 and 4 mi. e., and 10 mi. ne.)

KERN COUNTY:
- Famosa
- Dow
- Saco
- Rio Bravo
- Rosedale
- McKittrick (also 3 mi. n.)
- Fellows
- Midoil
- 10 mi. ne. of Taft
- Maricopa (also 10 mi. e.)
- Pentland
- Tupman
- North shore Buena Vista Lake
- 5 mi. w. of Stevens
- Old River (also 7 mi. w.)
- Greenfield (also 6 and 7 mi. s.)
- Reed Station
- Bena
- Ilmon
- Emigdio Station (also 3 mi. e. and 3 mi. w.)
- Wheeler Ridge P. O. (also 4, 5, 7, and 9 mi. n.)
- Grapevine (also 12 mi. n.)

LOS ANGELES COUNTY:
- 3 mi. se. of Gorman*
- Castaic
- Saugus (also 1 mi. n., 2 mi. nw., and 6 mi. ne.)
- 7 mi. n. of Newhall
- 4 mi. nw. of Sunland.
- Verdugo Hills
- Alhambra
- 9 mi. e. of Azusa

SAN BERNARDINO COUNTY:
- Ontario
- Alta Loma
- Rialto
- San Bernardino
- Muscoy
- Highland Junction
- San Bernardino Mountains

RIVERSIDE COUNTY:
- Mira Loma
- Riverside
- West Riverside
- Lakeview
- San Jacinto
- Andersons
- Perris
- Elsinore (also 7 and 9 mi. ne.)
- Sedco
- Wildomar
- Murrieta
- Temecula

* May be *candida* intergrade.

ORANGE COUNTY:
- El Toro
- Galivan
- San Juan Capistrano
- Coast Royal

SAN DIEGO COUNTY:
- San Mateo Creek (at US 101)
- San Onofre
- Stuart
- Between Oceanside and Carlsbad
- La Costa
- Leucadia
- Encinitas
- Cardiff
- Solana Beach
- La Jolla (type locality)
- Pacific Beach
- Murphy Canyon
- Rosedale
- Grantville
- Mission Valley
- San Diego
- Otay
- Tia Juana
- Monument 258 (International Boundary at Pacific Ocean shore)
- Bonsall
- Hodges Dam
- Poway
- Mussey (also middle of Mussey Grade)
- Mission Gorge
- Santee
- Lakeside
- Lakeview (=Johnstown)
- Ballena
- Ramona (also 3 mi. w.)
- Warners Hot Spring
- Warners Ranch
- 3 mi. w. of Warners Ranch House (=3 mi. n. of San Felipe)
- Pine Valley
- La Posta
- Campo

BAJA CALIFORNIA, MEXICO
- Tijuana
- Ensenada
- Punta Banda
- Santo Tomás
- Valle de la Trinidad
- San José (lat. 31° N.)
- San Quintín

Arizona elegans pacata subsp. nov.

PENINSULA GLOSSY SNAKE

Type.—No. 17652 in the collection of the San Diego Society of Natural History. Collected Nov. 16, 1941, by Frank F. Gander, at Santo Domingo (lat. 25° 30′ N.), Baja California, Mexico.

Diagnosis.—A subspecies characterized by a low number of body blotches (39 in the holotype), subcircular in shape, as compared with the other western subspecies (*occidentalis, eburnata, candida, philipi,* and *noctivaga*) which ordinarily have 50 or more rectangular blotches, averaging close to 60. Other subspecies having low numbers of dorsal blotches are *elegans* and *expolita. Pacata* differs from the first in having 27 rather than 29 or 31 scale rows; and from the latter in having a proportionately shorter tail and fewer subcaudal scales.

Description of the Type.—The type specimen is an adult male; length over-all 789 mm.; tail length 94 mm.; tail proportion 11.9 per cent.

This is a snake of moderate body shape, neither racer-like nor particularly stout. There is a prominent vertebral ridge. The head is flat-topped, rather narrow, and little distinct from the neck. The diameter of the eye is about 60 per cent of the distance from its anterior edge to the nostril. The pupil is slightly higher than wide.

The scales of the head are normal. They comprise a sharply recurved

rostral, considerably wider than high, and with the posterior point separating the internasals for about half their lengths. The internasals are longer than wide and have sharp points between the rostral and prenasals. The prefrontals are quadrangular in shape, with their lateral edges curved downward over the canthus rostralis. The frontal is hexagonal, and is longer than wide; it is wedge-shaped at its terminus between the parietals. The supraoculars are in contact with the prefrontals; they widen posteriorly. The parietals contact more than half of the upper postoculars. Posteriorly they are edged by slightly enlarged dorsal scales. Of the nasals the posterior is the larger; there is no separating suture above the nostril. The postnasal touches the first and second supralabials. There is a single quadrangular loreal on either side about twice as long as high, touching the second and third supralabials; the lower edge is considerably longer than the upper. The preoculars are 1–1; postoculars 2–2, the lower slightly larger than its fellow. The temporals are 2+4. The supralabials are 8–8, the fourth and fifth touching the eye, and the seventh largest. The mental is small and triangular. The infralabials are 13–12; the first contact medianly behind the mental; the seventh on the right and the sixth on the left are the largest. The suture between the fifth and sixth is incomplete on the left. There are two pairs of genials, the anterior pair considerably the longer and medianly in contact; the posterior are divergent and are separated by two slim gulars.

The dorsal scale rows number 27–27–19. The scales are smooth, narrow and are rather pointed posteriorly. There are faint single apical scale pits. The ventral scales number 200; the anal plate is entire; there are 43 subcaudals, all divided.

The head is medium-brown above and somewhat lighter on the sides. There is a faint evidence of a postocular dark stripe toward the angle of the mouth. The lower surface of the head is unmarked.

The body pattern comprises a series of 39 subcircular brown blotches. The blotches are not sharply differentiated from the adjacent dorsum except that the edges are somewhat dark. In addition, the scales outside the blotches have their edges lightened to a greater extent than those within, thus causing the blotches to be accentuated. At mid-body the blotches are about 4 scales long (end to end), and 11 scale rows wide. The interspaces entail about 1½ scales (end to end). Below the blotches on either side there is a secondary series of smaller round spots which are not very clear, and below these there are other irregular marks on a background which becomes increasingly light toward the ventrum. The lowest lateral row on either side is immaculate cream, as is the ventral surface. There are about 12 spots on the tail; one cannot be sure of the count since they become indefinite posteriorly.

Remarks.—This specimen is the only one from the southern half of Baja California of which I have knowledge. The most southerly specimen previously known was from San Quintín. This leaves a gap of over 400 miles, and I should be justified in making *pacata* a full species were the differences greater. But since the differences seem to be largely in pattern, and because the interven-

ing territory is of such a character that intermediate specimens are to be expected, I accord it only subspecific rank.

Additional specimens of *pacata* will probably show that it averages fewer ventrals and subcaudals than either *occidentalis* or *eburnata*, the territorially nearest subspecies.

Range.—This subspecies is known only from the type locality, Santo Domingo (lat. 30° 30′ N.), Baja California, Mexico. No doubt it has an extensive range in the south-central part of the peninsula.

PHYLOGENY

In differentiating the several subspecies of *Arizona*, the most consistent characters—territorially—are those which separate them on an eastern-western basis, these being tail proportionality and dorsal scale rows. The tail proportionality carries with it differences in subcaudals. The ventrals and body blotches, while consistent in local populations, this being particularly true of the former, tend to duplication in widely separated areas, as if influenced by conditions of regional ecology. Thus we have high ventral counts in *elegans* and *eburnata*, and low blotch numbers in *elegans* and *pacata*. Higher ventral counts are correlated with higher temperatures (Klauber, 1941, p. 73); fewer blotches and darker colors with greater brush cover and a less exclusively nocturnal existence. All of these considerations suggest that the most fundamental differences lie in tail length and scale rows, and, of these, I should place tail proportionality first. Had these two characters divided the subspecies with a co-ordinated consistency, I should have been tempted to formulate two species; such an eventual conclusion is still by no means impossible, since as yet it has not been finally determined (through lack of material from critical areas) whether *philipi* (or its southern extension *expolita*) intergrades or overlaps with *elegans-blanchardi* to the east, or with *noctivaga* to the west. But since *philipi* is intermediate, being eastern in tail length and western in scale rows, I have concluded that it would be most logical, for the present, to continue to consider *Arizona* monotypic.

It is my view that the species arose in north-central Mexico, radiating northward from there. *Blanchardi* is a northern extension of *elegans*, and *philipi* of *expolita*. *Eburnata* constitutes the main western branch, as at present known, but I hazard the guess that another form will be found in Sonora with fewer ventrals and larger blotches, from which *noctivaga*, *eburnata* and *pacata* all radiated, the latter across the Gulf of California. *Occidentalis* and *candida* are obviously off-shoots of *eburnata*. These conclusions are graphically summarized in figure 1.

Subspecific differences in scale and blotch counts, and tail proportions, are summarized in tables 2 to 7, inclusive.

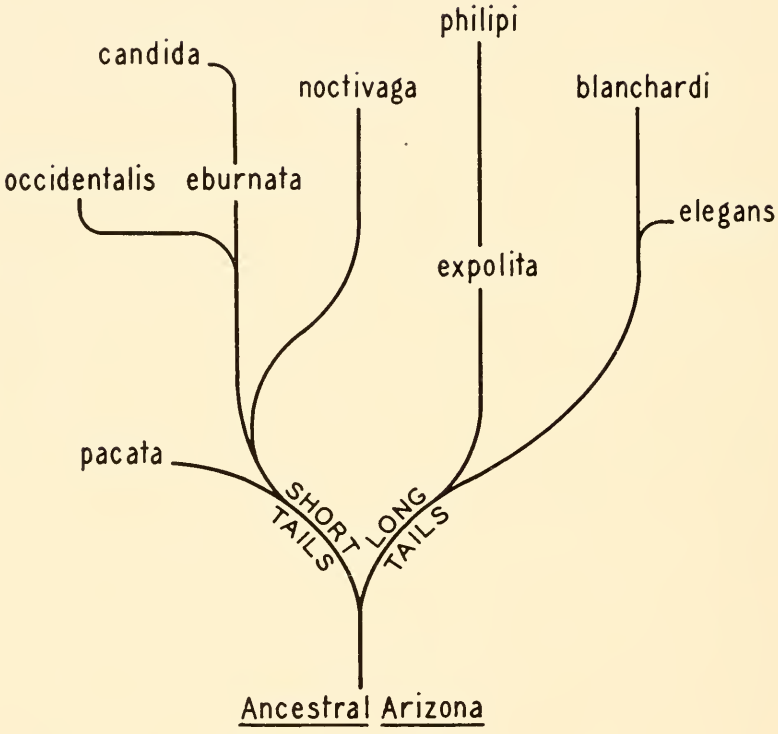

Fig. 1. The Phylogeny of *Arizona*.

Table 2

MEAN SCALE AND BLOTCH COUNTS

Subspecies	*Scale rows*	*Ventrals, males*	*Ventrals, females*	*Subcaudals, males*	*Subcaudals, females*	*Supralabials*	*Infralabials*	*Preoculars*	*Postoculars*	*Body blotches*	*Tail spots*
Elegans	30.1	214.7	225.1	56.4	51.6	8.11	13.14	1.03	2.01	49.1	18.0
Blanchardi	29.8	204.6	214.5	56.5	51.9	8.02	12.76	1.21	2.03	56.5	20.7
Philipi	27.1	192.6	203.2	53.2	47.9	8.02	12.98	1.03	2.00	62.0	19.3
Expolita	27.0	194.5	207.0*	51.0	39.0*	8.17	12.20	1.00	2.00	48.3	15.0
Noctivaga	27.2	208.8	219.2	49.1	45.4	8.08	12.90	1.07	2.02	58.5	18.3
Eburnata	27.3	219.5	231.2	51.8	47.8	8.04	12.81	1.04	2.03	68.5	20.4
Candida	27.1	214.2	223.4	50.9	46.3	8.08	12.65	1.63	2.01	62.9	18.6
Occidentalis	27.4	214.2	223.0	50.3	46.5	7.99	12.95	1.03	2.03	62.7	18.3
*Pacata**	27.0	200.0	—	43.0	—	8.00	12.50	1.00	2.00	39.0	12.0

* One specimen only

Table 3

Extreme Ranges of Scale and Blotch Counts

Subspecies	*Ventrals, males*	*Ventrals, females*	*Subcaudals, males*	*Subcaudals, females*	*Body blotches*	*Tail spots*
Elegans	208–222	220–232	51–62	49–53	42–56	13–24
Blanchardi	197–215	207–222	52–63	47–55	47–66	15–27
Philipi	185–203	193–211	51–57	45–51	52–72	15–23
Expolita	194–195	207*	49–53	39*	45–50	12–13
Noctivaga	204–214	211–224	46–52	43–48	52–67	15–23
Eburnata	208–228	220–241	47–59	43–54	55–83	15–29
Candida	208–220	220–232	47–55	44–49	55–73	14–24
Occidentalis	207–223	215–231	47–54	43–50	51–75	13–25
*Pacata**	200	—	43	—	39	12

* One specimen only

Table 4

INTERQUARTILE RANGES OF SCALE AND BLOTCH COUNTS

Subspecies	*Ventrals, males*	*Ventrals, females*	*Subcaudals, males*	*Subcaudals, females*	*Body blotches*	*Tail spots*
Elegans	212.3–217.1	223.1–227.1	54.3–58.4	50.7–52.5	46.6–51.7	16.0–19.9
Blanchardi	201.4–207.9	211.2–217.9	54.6–58.4	50.4–53.4	53.0–60.1	18.8–22.5
Philipi	188.6–196.5	199.2–207.2	52.2–54.3	46.7–49.0	58.6–65.4	17.7–20.8
*Expolita**						
Noctivaga	207.0–210.6	216.7–221.7	48.1–50.1	44.3–46.5	56.2–60.8	17.1–19.6
Eburnata	216.5–222.6	229.0–233.4	50.3–53.4	46.1–49.4	64.3–72.8	18.6–22.1
Candida	212.3–216.1	221.2–225.6	49.7–52.1	45.4–47.2	60.3–65.6	17.0–20.2
Occidentalis	211.8–216.7	220.2–225.8	49.1–51.4	45.2–47.8	59.3–66.1	16.7–20.0
*Pacata**						

About half the individuals in a population will fall within the interquartile range.

* Insufficient specimens

Table 5
DISTRIBUTION OF SCALE-ROW COUNTS AT MID-BODY

Subspecies	Scale Rows						
	25	26	27	28	29	30	31
Elegans			1		16	2	21
Blanchardi					21	3	12
Philipi	1		28		2		
Expolita			3				
Noctivaga	1		57	5	7		
Eburnata	2		154	4	25		
Candida		1	80		3		
Occidentalis		1	68	4	16		
Pacata			1				

Table 6
MEAN RATIOS OF TAIL LENGTH TO LENGTH OVER-ALL

Subspecies	Males	Females
Elegans	.149	.142
Blanchardi	.157	.147
Philipi	.161	.148
Expolita	.158	.125*
Noctivaga	.137	.127
Eburnata	.137	.126
Candida	.139	.125
Occidentalis	.136	.125
Pacata	.120†	—

* Only one specimen; believed to be low.
† Only one specimen.

Table 7
MODAL BLOTCH DIMENSIONS

Subspecies	*Width of blotch in scale rows*	*Length of blotch in scales, end-to-end*	*Interspaces in scales, end-to-end*
Elegans	14	3	1
Blanchardi	13	2¼	1
Philipi	11	2	1
Expolita	14	3	1¼
Noctivaga	11	2	1½
Eburnata	7	1¼	2
Candida	9	1¼	2
Occidentalis	9	1½	1½
Pacata	11	4	1½

A KEY TO THE SUBSPECIES OF *Arizona elegans*

1 a	Dorsal scales at mid-body in 31 or 29 rows	2
1 b	Dorsal scales at mid-body usually in 27 rows; not over 20 per cent of the specimens with 29 rows	3
2 a	Ventral scutes in the males usually exceed 210, and 221 in the females; body blotches (not including those on the tail) usually less than 54	*elegans*
2 b	Ventral scutes in the males usually 210 or less, and 221 or less in the females; body blotches (not including those on the tail) usually 54 or more	*blanchardi*
3 a	Ratio of tail length to length over-all in adult males usually exceeds 15 per cent and 13½ per cent in adult females	4
3 b	Ratio of tail length to length over-all in adult males usually less than 15 per cent and less than 13½ per cent in the adult females	5
4 a	Body blotches usually 51 or less	*expolita*
4 b	Body blotches usually 52 or more	*philipi*
5 a	Body blotches equal or exceed the interspaces in longitudinal extent	6
5 b	Body blotches of less extent longitudinally than the interspaces	8
6 a	Body blotches less than 45	*pacata*
6 b	Body blotches 45 or more	7
7 a	Marks on edges of ventrals; often with spots on infralabials; color generally darker	*occidentalis*
7 b	No marks on edges of ventrals; infralabials clear, except occasionally a spot on the last infralabial; color generally lighter	*noctivaga*
8 a	Lowest lateral spots on the edges of the ventrals or the row next to the ventrals; color darker	*occidentalis*
8 b	Lowest lateral spots rarely touch a lateral scale row below the second above the ventrals; color lighter	9
9 a	One preocular; dorsal blotches at mid-body rarely span more than 7 scale rows	*eburnata*
9 b	Usually two preoculars; dorsal blotches at mid-body usually span 9 scale rows	*candida*

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Abbreviations

The following abbreviations are used for the museums whose specimens are mentioned by number in the text.

AMNH	American Museum of Natural History
CAS	California Academy of Sciences
CHAS	Chicago Academy of Sciences
CNHM	Chicago Natural History Museum
KU	Museum of Natural History, University of Kansas
LMK	Collection of L. M. Klauber
MCZ	Museum of Comparative Zoölogy, Harvard University
MVZ	Museum of Vertebrate Zoölogy, University of California
NHMSU	Natural History Museum, Stanford University
PFNM	Collection of Petrified Forest National Monument
SDSNH	San Diego Society of Natural History

UCLA	University of California at Los Angeles
USNM	United States National Museum
WSC	Charles R. Conner Museum, The State College of Washington

SUMMARY

The monotypic genus of snakes *Arizona*, of the southwestern United States and northern Mexico, is surveyed. Seven new subspecies are described: *A. elegans blanchardi*, *A. e. philipi*, *A. e. expolita*, *A. e. noctivaga*, *A. e. eburnata*, *A e. candida*, and *A. e. pacata;* these, with the previously described subspecies *A. e. elegans* and *A. e. occidentalis*, make a total of nine. Tail length, scale rows, ventral scutes, and pattern are found to be the most important characters in segregating subspecies. Ranges and locality records, ecological and field notes are given. Relationships are discussed, and lines of descent are suggested. A key is given.

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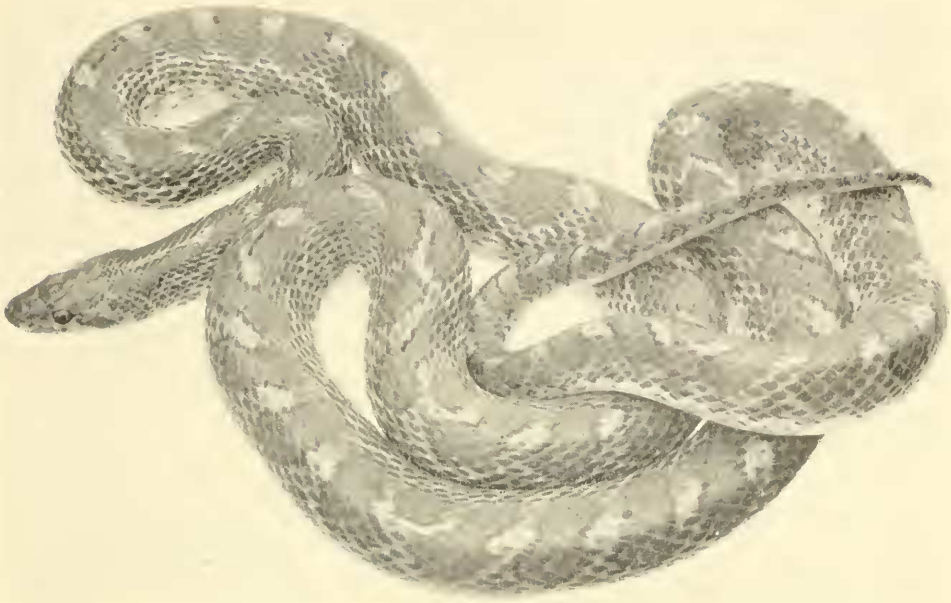

Fig. 1. *Arizona elegans elegans.*
Adult male from 7 miles southwest of Somerset, Bexar County, Texas.
Collected by A. J. Kirn: Photograph by L. C. Kobler.

Fig. 2. *Arizona elegans occidentalis.*
Adult female from Campo, San Diego County, California. Collected and photographed by J. R. Slevin, California Academy of Sciences.

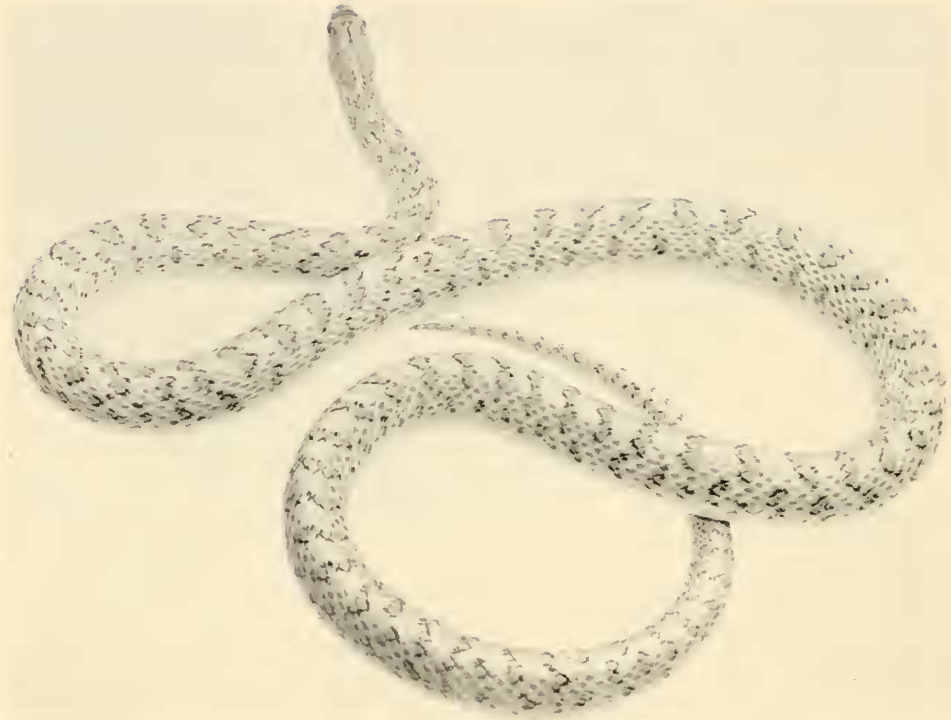

Fig. 1. *Arizona elegans eburnata.*
Adult male from Borego Palm Canyon, San Diego County, California.
Photograph by L. C. Kobler.

Fig. 2. *Arizona elegans candida.*
From Neenach, Los Angeles County, California. Collected and photographed by C. M. Bogert, American Museum of Natural History.